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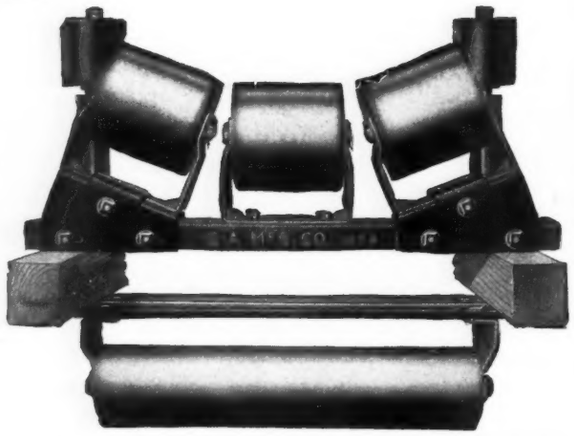

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ROCKY GROUND AND HARD, ROUGH BEDROCK IN SIBERIAN OPENCUT WHERE DREDGE WILL OPERATE

Drift-Gravel Mining in Eastern Siberia

BY JOHN POWER HUTCHINS*

The drift-gravel deposits that are worked in the Trans-Baikal and Lena River regions of eastern Siberia are rich and extensive, but are mined by such crude and wasteful methods that the losses are probably 33⅓%, and the costs from 2½ to 7 times as great as at similar deposits in California. Modern methods and efficient labor would convert this vast field into one of great productivity.

NEARLY 80% of the gold produced in Russia is won by mining alluvial deposits, and much of this gold comes from eastern Siberia, east and northeast of Lake Baikal. The chief interest that can be attached to a description of gravel mining in Siberia lies in the possibilities that the region affords if modern equipment and methods could be introduced. What follows may be said to show how not to mine, for with typical costs, under pre-war conditions, of $2.50 to $3 and $8 to $9 or more per cu.yd., and labor at only 50c. and $1 per day respectively, it is perfectly obvious that little can be learned by the study of such methods.

The alluvial deposits mined occur in the beds of former streams now filled with washed gravel, clay, sand, etc., to a depth, in places, of 150 ft. The pay material occurs near, on and in the bedrock, often to a depth of from six inches to three feet or more.

In mining the channel is usually blocked out in areas not more than 500 ft. square, 420 ft. being the average size. If the channel should be 1400 ft. wide, as sometimes occurs, it would require three shafts in line across the channel to mine it by the Russian method.

A shaft, usually 14 ft. square in cross-section, is sunk to bedrock in the middle of the block, and two so-called

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"corridors," one a drift along the length of the channel and the other a crosscut to both rims, are driven. These corridors are about 14 ft. wide and at least 7 ft. high. They are sometimes 14 ft. high, if the pay gravel is more than 10.5 ft. deep. The Russian usually works his mine by piecework, and the workmen were paid before the war by the cubic *arshine* of 12.7 cu.ft., which is 28 x 28 x 28 in., or by the cubic *sagene* of 343 cu.ft., which is 7 x 7 x 7 ft. As it is easier to measure the amount of material mined if it is breasted 7, 10½, or 14 ft. deep (1, 1½ or 2 *sagenes* being multiples of a familiar Russian standard of linear measure), the corridors are generally driven at such heights. This may appear to be an insufficient reason, but it is, nevertheless, usually the true one. The pay gravel is often only three to four feet or less thick, but the system of mining is such that thin pay streaks cannot be mined cleanly, as in other countries, and much barren or low-grade gravel is admixed.

Mine One-Half Worked When Developed

After the corridors have been driven 28 ft. from the shaft, drifts and crosscuts 14 ft. wide and 7 or 14 ft. high are started in both directions from each of the four ends of the corridors. When these are in 28 ft. they connect, and other crosscuts and drifts 14 ft. wide and 7 or 14 ft. high are started at right angles to the first set where they meet. This general system is continued until the boundaries of the channel and block are reached, at which time the ground has been three-fourths excavated, leaving 14 ft. square pillars as unworked gravel. In other words, the mine is one-half worked out at the same time that it has been developed to its limits, and the mine plans look like a chessboard. The pillars are then mined, beginning at the most distant corners of the property and working toward the shaft. Considerable ground and timber are lost by caving. When pillars are insufficient near shafts and main drifts, much timber is required.

Gravel is shoveled into home-made wheelbarrows or, infrequently, into equally bad home-made cars, and trammed respectively over boards or rails to the shaft, where the wheelbarrows or cars are dumped directly into a skip. It is seldom that a loading pocket is provided. Much time is lost, and the men sometimes wheel the gravel distances of more than 500 feet.

Excessive Timbering Common

Timbering by the Russian method seems to require as much timber as possible, rather than as much only as is necessary, and consequently the operation is expensive. As the entries are advanced, the face is followed by close-timbered sets having two vertical posts and a single cap. Timbers consist of poles 7, 10½, or 14 ft. long for posts, and 14 ft. long for caps, 4 to 6 in. in diameter at the small end. When a drift has been advanced 14 ft. timbers 12 in. or more in diameter and 14 ft. long are inserted, longitudinally under the caps and against each post inside the timber set. The center of each reinforcing piece coming under the cap, and strong posts, placed perpendicularly, support it under each end and sometimes also at the middle, and are therefore accordingly set 14 to 7 ft. apart. Thus, in the first stage of timbering, the posts and caps are like those in American tunnel timber sets, except that the posts are vertical. When the second stage of timbering is finished, the posts and caps of the first stage become lagging, supported and reinforced by the inside heavy timbers. The heavy timbers are supposed to take all or most of the weight, but the posts standing without batter cannot resist lateral pressure, and trouble often results.

Several Years Required to Work Single Shaft

As the capacity of the horse whims which are used is small (50 to 60 cu.yd. per *suitkee*, or 24 hours), the rate of hoisting per shaft limits the crew to from 50 to 60 men. For this and other reasons, it takes several years (often three or four, or as many as eight in known instances) to exhaust the ground tributary to one shaft; that is, about 420 to 500 ft. square; and some of the timbering near the shaft often must actually be renewed before the deposit is worked out. Pillars are robbed so slowly that they must be timbered during the process. Timbering costs in the Trans-Baikal about 30c. per cu.yd. for ground that is sometimes solidly frozen, and in the Lena regions sometimes more than $1 per cu.yd. Similar ground is mined in America with little or no timbering, because it is mined rapidly, and the breasts are advanced faster than the worked-out ground will cave behind the miners. Where steam or electric hoists are used, more than 100 cu.yd. can sometimes be mined per 24 hours and hoisted through one shaft; and more than 100 men can be worked in a block tributary to one shaft.

Each block of ground is, therefore, often a separate and distinct mine, with its own shaft and hoist, and frequently its own pump. This arrangement is not only typical of gravel mining in Russia, but is the general practice in all kinds of mining throughout that country. The Russian miner, when he wishes to produce at a faster rate, sinks more shafts and installs more hoists and pumps. As in everything else, he mines on the one-man-proposition scale. Thus, when he wants to haul large quantities of any material, he simply uses more one-horse carts, each loaded with one-quarter to one-half ton, instead of hitching his animals together and using fewer wagons and hauling considerably more per animal and per driver. He could just as well work several blocks of ground through one shaft, tunnel, or incline. Indeed, there are places where a bedrock tunnel would have obviated all hoisting and pumping, but the channel is, nevertheless, worked from its very outcrop by shafts 500 ft. apart, where a tunnel would have been in pay gravel from its portal.

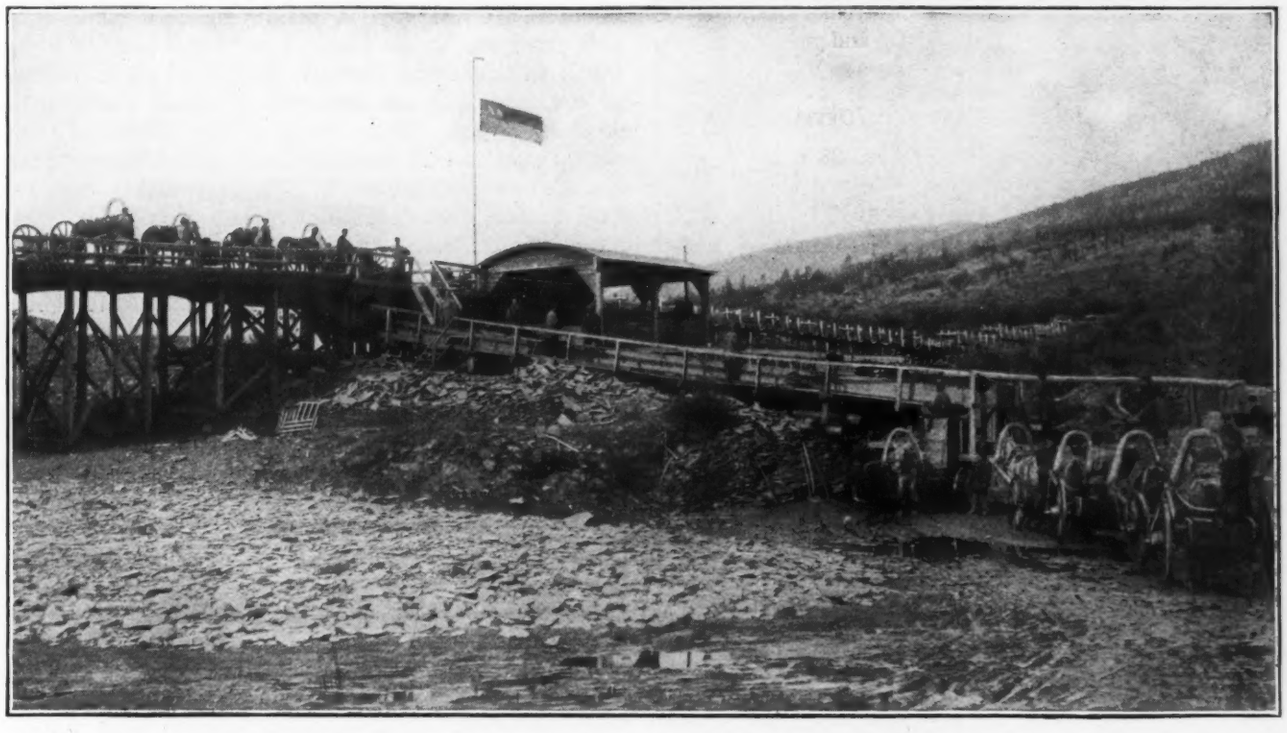
Four-Horse Whims Used for Hoisting

The hoist often consists of a four-horse whim winding a manila or wire rope, and two buckets to each shaft. The horses are driven at a fast trot while hoisting. At some shafts electric or steam hoists and wire ropes are used, and one mine has a wire rope 1¼ in. in diameter and an 80-hp. motor to hoist a skip holding less than one ton from a depth of only 100 ft. It required about 25 seconds to hoist. The skip is hoisted even more slowly when four horses are used. The skip bottom, to which is often hinged two doors, is dumped by driving out two wedges, and the gravel falls on two inclined chute gates that form an apex by closing over the shaft mouth and which resemble the peaked r[illegible]

of a house. The gravel then slides into cars or carts, or sometimes to the ground, when it must be again shoveled into some sort of vehicle.

In winter, when it is not considered possible to wash gravel, it is hauled to a storage dump, except in the few properties where winter washing is practiced. In summer, the gravel may be hauled directly to the washing plant.

At many mines, gravel is hauled to the washing plant in one-horse dump-carts holding about 7 cu.ft. each, or in cars of about 9 cu.ft. capacity. Cars are run to an unloading cradle, which turns the car upside down over a gridiron, with about 10-in. square openings. Often the car is partly lifted by six men and dumped by turning upside down or by rolling. During the 30 minutes that I watched cars going to the washing plant of one large mine, one-third of the cars left the rails within view, and I had no means of knowing how many more cars were off that part of the track not visible.



WASHING PLANT IN THE LENA REGION, SITUATED IN A VALLEY BOTTOM

Siberian Gravel Often Combined With Clay

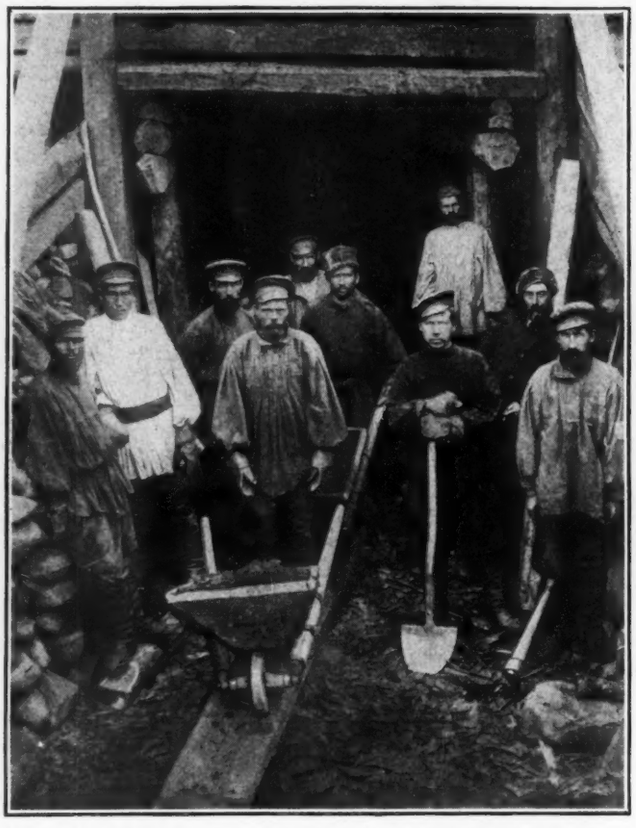
Much of the gravel of Siberia is clayey, and needs disintegration, in which case *chashas*, to be described later, are used. The usual washing plant has a capacity of about 250 cu.yd. in 24 hours, when clayey gravel is washed, and requires about 250 miners' inches, or about 6 cu.ft. per second of water. In other words, about 1 cu.yd. of gravel is washed per miners' inch per 24 hours, or a duty of 1 cu.yd. is obtained. It is interesting to compare the respective duties in placer-mining operations elsewhere. In dredging a duty often more than 10 cu.yd. per miners' inch is had; in hydraulicking, where the water not only washes but also excavates and transports gravel to and through the sluices and to and along the dump, a duty of over 5 cu.yd. per miners' inch per 24 hours is frequently attained. Even in hydraulic elevating, where two-thirds of the water must be used in elevating, a duty greater than 1 cu.yd. per miners' inch per 24 hours is obtained for the total amount of water used. This clearly indicates the great quantity of water wasted by the Siberian washing machine, which has a washing efficiency of only 10% of what it should have. Even in washing partly cemented gravel at drift mines in California a duty of 6 to 12 cu.yd. per 24 hours is had, and much more water is needed to wash such gravel than is required even by the clayey gravel of Siberia. Even when milling hard cement gravel in California a duty of 3 to 4 cu.yd. per miners' inch is obtained.

At the particular washing plant visited there was a small supply of water, so the operators were able to wash only 20 to 30 hours per week, and as a result production had to be conducted within this limit. This plant is typical for Siberia, where the clayey gravel, as stated, requires disintegration. The gravel is dumped into a sluice 2 ft. wide and 30 ft. long, with a drop of 18 in. in 12 ft., or 12½% grade. The sluice has a false bottom of plates with ¾-in. perforations, and set three inches above the bottom. Water enters at the upper end, and no spray or sparge-pipes or nozzles are used anywhere in the plant. The object of this sluice is to catch the coarse gold and to allow the large lumps to be broken by hand with a pick as the lumps slide or roll down the plates.

The sluice leads into a *chasha*, or disintegrator, which is similar in design and operation to an *arrastra*, with the difference, however, that it disintegrates instead of crushes. It has 4, 6 or 8 radial arms, each about 5 ft. long, and these have iron-shod projections which drag on a perforated cast-iron bottom having 1-in. holes. Material less than 1 in. in diamater drops through to a set of tables 10 ft. wide and 30 ft. long with a slope of 27 in. in 12 ft., or an 18¾% grade. There are

occasional rifles on these tables, and the attempt is made to save gold, not as in other countries, below the riffles, but above them. Material packs above each riffle, and there is therefore not the agitation desired in placer mining elsewhere in the world. The oversize from the *chasha* is removed intermittently when it accumulates, by opening a door in the bottom, allowing it to fall on to a chute, and thence into a car. A horse hauls this material to a waste dump. When the gravel is clayey, the oversize often contains considerable gold, and it is then customary to give it a re-washing.

After passing over the tables, below the first *chasha*, material and water flow to a second *chasha*, which is similar to the first except that it has ½-in. instead of 1-in. holes. The undersize then drops on to a similar



CRUDE TOOLS AND TIMBERING IN SIBERIAN MINES

set of tables with slopes of 24 in. in 12 ft., or 16⅔% grade, and the oversize is thrown over the side by centrifugal force and hauled away to the waste dump. This oversize product is also usually re-washed.

The undersize material passes through a third *chasha* with ¼-in. openings. The undersize and oversize fall on to similar tables with slopes of 18 in. in 12 ft., or 12½% grades, and thence travel through a tail-sluice 4 ft. wide with slope of 14 in. in 12 ft., or 9⅜% grade, to the waste dump.

The revolutions per minute of the three *chashas* range from 15 to 20, 24 to 32 and 15 to 20 respectively, depending upon the amount of material being washed and the steam pressure available. They are driven by one 25-hp. engine.

While in principle the *chasha* is the best of all devices for disintegrating clayey gravel, as operated in Siberia it does poor work. I have seen 17 children stealing lumps of clayey gravel from a dump composed of oversize from the first *chasha* of a washing plant, and I was told by them that they saved from 15c. to $1.50 per sack of dirt, which I estimated to weigh less than 50 lb. It is possible that this dump contains not less than 50c. and possibly more than $1 per cu.yd. on an average; I have worked such a dump with a plain sluice and recovered over 50c. per cu.yd. In other words, probably 10 to 20% is lost from the first *chasha*. Then there are also losses from the next two *chashas*, and from the tables and sluices. The aggregate loss may in instances total more than 33⅓% of the total content.

As at present operated, the *chasha* is fed intermittently and then stirred, after which the oversize is dumped intermittently. It is therefore the last material fed that may be the first to be removed. An arrangement of *chashas* in series, allowing material to pass from one to the other, insures the passing of all the largest oversize through several *chashas*, instead of one, and such an arrangement would undoubtedly do cleaner work. These machines are capable of operating in series with constant feed and discharge. They can also be doubled-decked like the *chashas* that are used in the Ural Mountains, which would permit of finer disintegration, with arms closer together on the lower deck and constant feed to the lower deck *chashas*. A proper arrangement of spray pipes and nozzles would help the operation considerably.

Trommels Used for Clay-Free Gravel

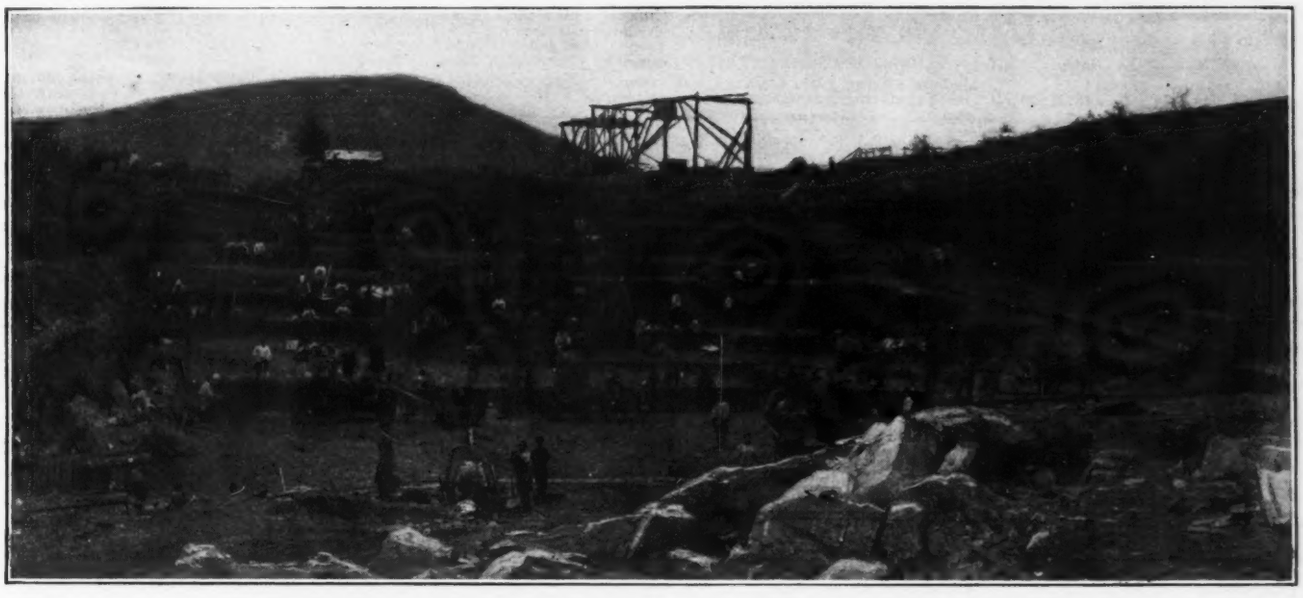
When there is no clay in the gravel, the boulders are separated by passing the gravel through trommels with 2- to 4-in. perforations. A well-designed trommel has proved the best service for screening out boulders, and helping to transport this oversize to cars, belts or buckets for disposal over the waste dump. Siberian trommels are poorly designed and badly built. They usually have an inside iron shaft about 4 to 6 in. square which has cast or wrought iron arms attached to it and held with wooden wedges. The plates are riveted to these arms, and with such a mass of obstructions the trommels often become clogged, causing both trouble and delay.

Wood Fires for Thawing

Much of the ground in the Nerchinsk district and some in the Lena region is frozen. Such ground is thawed by means of wood fires, as was first done in the Klondike and Alaska, or with charcoal. As a result of using charcoal, which is the more general practice, poisonous gases are produced, which make it necessary to have good ventilation. Such ventilation causes thawing of frozen ground in summer in workings or openings where it is not desired, and makes timbering necessary where little or none should be required. In Alaska the duty of one cord of wood in steam-thawing is sometimes 60 cu.yd.; the duty by direct wood-thawing is about 10 cu.yd. The Siberian still clings to wood or charcoal thawing, thinking it better. The reason is that he does not think it possible to drive steam-points into gravel. Similarly, it is "impossible" to drive Keystone or Empire drilling pipe in Siberia, according to native ideas. It has been observed in many instances that what is thought "impossible" in Russia is merely called "hard work" elsewhere in temperate and subarctic regions.

The climate of most parts of Russia is one that makes for efficiency; it is constantly necessary to work hard for a living, particularly in summer, in order to exist during the long winter, and industry and frugality are essential. Alaska has probably the most efficient workmen in the world; but Russia, the enigmatic, has perhaps the poorest, outside of the tropical and sub-tropical countries. The reason is apparently simple, because the people have few wants and few incentives, and therefore do not know how to work hard when working for others. They still work as they did in serfdom—doing as little as possible.

It is extremely difficult to get good native foremen in Siberia. Russian laborers are not generally ambitious; often foremen are not paid much more than the men under their supervision, and sometimes they are actually paid less. This often results in the foremen being among the laziest and least ambitious. They are often required to assume unusual and inequitable responsibilities, which may, for example, result in their being sent to jail for months in the event of a workman being killed, even through the latter's own carelessness—discouraging factors to the development of efficient mine foremen.



OPENCUT MINING IN THE LENA REGION, SHOWING SHAFT IN BACKGROUND

Cost of Trans-Baikal Drift-Gravel Operations

Drift-gravel operations cost $1.10 per cu.yd., to excavate, timber, hoist, tram, and wash, in the Nerchinsk region of the Trans-Baikal, where labor was about 50c. per day. Wood cost about $2 a cord. Administrative expense was about $1.40 per cu.yd., and the total cost about $2.50 per cu.yd. Operations are divided as follows: 38c. per cu.yd. to excavate, tram and to load the skip; 30c. to timber; 42c. to hoist, tram to plant and wash; total, $1.10 per cubic yard.

At the property for which these costs are given, all small tailings and part of large tailings were wasted by gravity; usually it is necessary to haul all larger and much of smaller tailings to dumps at an additional cost, often of more than 25c. per cu.yd. of gravel washed. Thus, with $1.40 per cu.yd. for administrative expense, 56% of the total working cost was for overhead charges, which in mining low-grade material is excessive. The cause of high administrative costs is the large force of office men and foremen as well as bad management. In some drift mines in Siberia the administrative expense alone is greater than the total cost for similar mines in Alaska. The costs given are from the region on the upper Amur River; costs in the Lena region are about 2.5 to 3 times as great, or about $6 per cu.yd., according to official reports, but the real cost is about $8 to $9 or more per cu.yd., as only about two-thirds or three-quarters as much ground is mined as is reported. The reason for this will be mentioned presently. I obtained most of the cost data given while consulting engineer to the cabinet of the Czar, when I had exceptional opportunities to obtain inside, though perhaps not accurate, information.

In the Lena region the basis of payment for miners was: For the first three units (1 cu. *arshin*, or 12.7 cu.ft.), Rs. 1.17 per cu.yd.; for the next unit, Rs. 1.68, and for the following unit Rs. 2.10 per cu.yd.; all transportation by wheelbarrow up to a distance of 280 ft. When the wheel was from 280 to 350 ft., 8 K. per cu.ar., or 17 K. per cu.yd., was added; when from 350 to 490 ft., 16 K., or 34 K., per cu.yd. was added; when more than 490 ft., 24 K., or 51 K., per cu.yd. was added.

It is probable that the ground reported as mined in nearly all Siberian drift-gravel operations is at least 20 to 33⅓% more than that actually mined. This has been checked carefully by several engineers, and has been found to be the case at a number of important properties in different parts of Siberia. With the contract system of payment there is the constant temptation for the miners to bribe the mine shift bosses to report more ground than is actually mined. Then, when a piece of ground has been mined, and the excavation is being measured, there are several miners to one foreman trying, and usually succeeding, in getting credit for more ground than is actually mined. The Siberian miners are clever at moving bench marks and survey stations, and the fact .that working faces are numerous,

short and scattered makes it difficult to measure accurately or to check alterations and reference points. The effect on grade and costs based on volumes so derived is obvious. Assuming that 33⅓% more than actually mined is reported, which as a matter of fact is often the case, it means that the real grade of gravel is 33⅓% more than the apparent, and the working cost is correspondingly increased. This makes the already high working cost, $6 per cu.yd., as given in official reports, even higher, it being actually $8 to $9 per cu.yd. in many instances, though this appaling cost for mining ground that can be worked with a pick is now less than it was some years ago.

In Alaska and the Klondike the actual cost of drift mining varies from $2.10 to $4.50 per cu.yd., depending principally on whether the gravel is frozen or unfrozen. When gravel is unfrozen in Alaska, expensive timbering and pumping are required. The Alaska workman excavates from three to five times as much gravel per day as the Siberian, and he is paid six to eight times as much. Wood in Alaska costs about six times as much as in Siberia. Lumber costs 3½ times as much. Food supplies cost about five times as much.

The Alaskan mines about 3 cu.yd. per day, and in some mines as much as six, and receives $6, and the Siberian digs 1 cu.yd.. and receives 50c. to about $1 per cu.yd., this part of the work in Alaska varying from an equal cost per cubic yard to about two to four times as much as in Siberia, but the less cost for timbering, hoisting, washing, etc., in Alaska more than counterbalances the high cost for breaking the ground. These figures indicate the large saving that can be effected by improvment in methods.

The cost of digging, tramming and skip loading is low in Siberia, being only 40c. to $1 per cu.yd. With good methods, in the subsequent operations, the total working cost should be reduced 50 to 75%. In other words, poor hoisting, transportation methods, washing, and supervision raise costs to what are, in many instances twice as great as those for mining in the most expensive parts of Alaska, where the cost of labor, timber, fuel, and supplies is from five to eight times as much as in Siberia, and where freight rates are often higher than first class or letter postage.

Drift mining in the Nerchinsk region should cost $1 per cu.yd. and in the Lena region $2.50 per cu.yd.; and these estimates are about one-half of the reported and about one-third of the actual working costs. Probably the most serious physical obstacle to cheap mining in Siberia is the often rough and uneven bedrock, although this is not an exceptional condition in drift-gravel deposits. Were a modern method of mining practiced this difficulty could be minimized.

Comparison with California

Drift-gravel mining where the gravel is free and needs no blasting, but where considerable timber is necessary, as at the Hidden Treasure mine, in California, with labor averaging about $2.15 per day, costs about $1.38 per cu.yd. This cost is obtained even where there are tunnels, expensive to drive and maintain, often more than one mile long in "swelling" bedrock. Where gravel is cemented and requires much drilling and blasting, with crushing in a stamp mill to pass an 8- or 10-mesh screen, the total cost is $1.75 to $5 per cu.yd. for small-scale operations.

The gravel in Siberia, where unfrozen—and most of it now being mined is in this condition—corresponds to the gravel of the Hidden Treasure mine; and although labor and supplies cost from three to five times as much in California as in Siberia, the Siberian mining costs are from 2½ to seven times as great, as evident from a glance at Tables I and II.

TABLE I. COMPARATIVE COSTS OF DRIFT-GRAVEL MINES IN CALIFORNIA AND SIBERIA

Mine	Entry	Kind of Gravel	Underground Transportation	Average Wages of Labor per Shift	Cost per Cubic Yard	Yield per Cubic Yard	Remarks
Hidden Treasure, Calif.	Tunnel 7 x 7 ft., 8,500 ft. long	Medium picking, little blasting, much timbering, free washing in sluice	Electric locomotive	$2.15	$1.38	$1.56	Tunnel cost $13 per ft. advanced 100-200 ft. per month in hard slate with air drills, hydro-electric driven compresser. Average 125 men employed. Tailings re-washed twice, showing existence slightly cemented gravel. Output per man-day, 6 cu.yd.
Bald Mountain, Calif.	Tunnel, 12,000 ft. long	Medium picking, little blasting, much timbering, free washing, required ⅛ to ¼ miners' inch to wash 1 cu.yd. in sluice	Steam locomotive, 7½ ton weight, 2-ton cars	2.20	1.65	2.30	Previous man tramming cost 15½c. per cu.yd. Previous mule tramming cost 6½c. per cu.yd. Locomotive haulage cost 3⅛c. per cu.yd.
Red Point, Calif.	Tunnel 2,000 ft. long and 4,000 ft. to dump	Medium cemented, single-hand drilling, blasting, washing (no milling) in sluice	Man and animal	2.40	1.90	3.25	
Paragon, Calif.	Tunnel 7,600 ft. long	Hard cement, hand drilling, blasting, stamp mill	Man and animal	2.70	4.87	15.00	Tunnel slope, 3 to 4 in. per 100 ft. Advanced 25 to 65 ft. per month with hand drilling
Mayflower, Calif.	Tunnel 4,640 ft. long and 8,500 ft. to mill	Hard cement, drilling, blasting, little timbering, stamp mill	Animal	2.75	4.87	10.50	Screen of gravel mill ¼-in. mesh, crushed 3½ to 8 cu.yd. per stamp per 24 hr. Used ⅛ to ¼ miners' inch per cu.yd. Milling cost 30 to 55c. per cu.yd.; 2½ lb. No. 2 dynamite used per cu.yd. and mined cost 12c. per cu.yd.
Typical mine, Tanana district, Alaska	Shaft 180 ft. deep	Solidly frozen, steam-thawing, little timbering, free washing in sluice	Man, car track	6.10	4.50	6.00	Pay gravel 100 ft. wide, 80 cu.yd. worked per day. Wood cost $16 per cord. Output per man-day, 5 cu.yd.
Typical mine, Trans-Baikal, Siberia	Shaft 110 ft. deep	Free picking, no blasting, no thawing, much timbering, much clay, disintegrating in chashas	Man with wheelbarrow	.50	Reported, $2.50 Actual, $3.50	5.00	This mine could have been opened by bed-rock tunnel and worked by California method for $0.80 per cu.yd. The output per man underground is less than 1 cu.yd. per shift
Typical mine, Lena River region, Siberia	Shaft 115 ft. deep	Free picking, no blasting, no thawing, much timbering, free washing in sluices of Siberian type	Man with wheelbarrow	1.00	Reported $6.00, Actual, $8.50	9.50	This mine could be worked by California method for about $2.50 per cu.yd. Output per man-day less than 1 cu.yd.

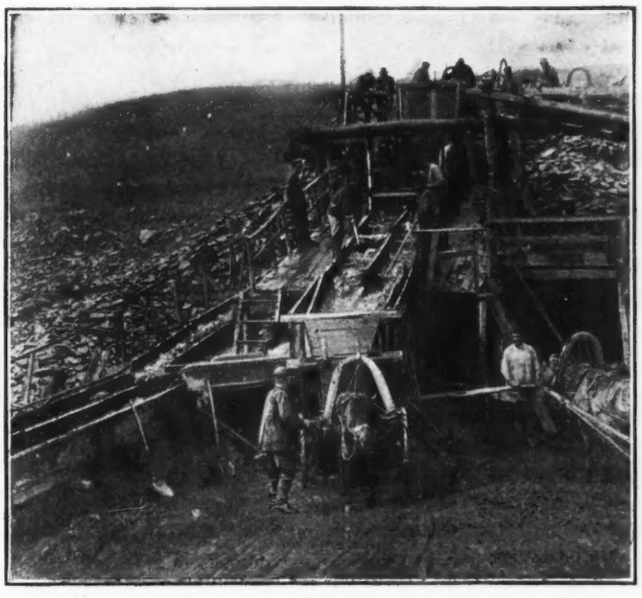
TABLE II. THE RELATIVE COST OF GRAVEL AND LODE MINING IN CALIFORNIA BY VARIOUS METHODS

	Per Ton
Auriferous quartz vein	$3.00 to $10.00
	Per Cu.Yd.
Drift gravel	$1.25 to $5.00
Miner's pan	5.00 to 8.00
Miner's rocker	3.00 to 4.50
Miner's sluice	1.00 to 1.50
Hydraulicking	.01½ to .10
Dredging	.01½ to .08

Costs are based on labor at $2.50 to $3.50 per shift.

By comparing these costs with Siberian costs, it will be seen that panning, the most primitive and most expensive method of mining, costs in California $5 to $8 per cu.yd., or sometimes less than large-scale drift-gravel mining in Siberia, where labor is less than $1 per shift. By comparison with the Transvaal, where costs are often only $4 to $5 per ton, it is apparent that it is often less expensive per unit of weight to mine hard rock from great depths and subject it to costly treatment than to work loose free-washing, clayless gravel from a depth of about 100 ft. in Siberia.

Probably the richest placer ground in the world of considerable extent has been mined in the Lena region, where one mile of stream bed produced about $55,000,000 worth of gold, or at the rate of about $10,000 per linear foot of channel. Good pay channels for drifting in California produced $100 to $500 per linear foot, although some were much richer. California channels worked by hydraulicking often produced $1000 per linear foot of channel. Rich channels in the Klondike



HAULING AWAY OVERSIZE FROM A WASHING PLANT

produced about $200 to $300 per foot by drifting. Much ground has been worked recently in the Lena region that has produced $20 or more in gold per cubic yard.

The future of drift mining in Siberia is not easy to predict, for unusual reasons. There are in the Lena region alone large volumes of gravel estimated to contain less than $6, but perhaps really containing up to $9 per cu.yd., and therefore unprofitable at the present real working costs. Much ground containing less than $8 to $9 per cu.yd. cannot be mined profitably by the present practice. With a cost of $2 to $2.50 per cu.yd., as can be had with good methods and management, there are probably millions of cubic yards of gravel that could be worked profitably. The future therefore depends largely upon whether the primitive methods now in vogue shall be improved and modernized. It is thought, though quite mistakenly, that modern drift mining cannot be introduced in Siberia, just as it is thought that modern methods could not be applied to vein mining. But this belief has been shown to be quite fallacious.

A large vein mine in Russia had been operated at a loss, using methods approaching in their wastefulness and extravagance the operations described in gravel mining. Foreign capital became interested, and drastic measures were taken. Many of those on the technical staff were discharged and foreigners were engaged and foreign methods introduced. A new Russian staff was then gradually built up and taught how to mine properly. As the new men learned, the foreign staff was displaced, until now, after about five years' operating, there are no foreigners at all at the mines or smeltery and low-cost work is being accomplished. This was not an easy undertaking, nor was it accomplished without bloodshed, one foreigner, in attempting to break up a gang of ore thieves, having been murdered. A similar policy, applied to drift mines, should reduce the costs to less than $3 per cubic yard.

Suggestions as to Improved Practice

That I may not seem to be bent only upon destructive criticism, I wish to make some suggestions of a constructive nature. It must be appreciated primarily that the physical conditions governing mining in Siberia are not unfavorable; and conditions for drift mining compared with other countries are really much less difficult. When suggestions are made regarding changes it is often urged by the mine managers that it has been tried and found impossible, whereas the real reason is that it has not been tried properly.

Siberian drift-gravel miners should use drill prospecting extensively and properly, both for quantitative and qualitative determinations. As now conducted, it can merely be considered as a qualitative test to determine the presence or absence of gold. Much money is wasted by subsequent groping and probing for pay streaks, with high and wide drifts and crosscuts, or big expensive shafts in wet ground. Empire and Keystone drills, which have proved so useful elsewhere in the world, are in Siberia considered unreliable. Drive-pipe is seldom if ever kept driven ahead of the tools; inaccurate samples are the result. The Keystone drill is not much used, for, as manipulated, it is expensive to operate, at times involving an expense of more than $7 per ft. One company expended $50,000 per year for drive pipe alone, much of which was lost by being left in the ground, as it was improperly driven, and so could not be pulled by the unskilled and ignorant drillmen.

Poor Prospecting Practice

Prospecting is never kept far enough ahead to make possible the planning of a comprehensive method or the installation of a plant good for several years' exploitation. The life of the usual Siberian drift mine is apparently only two or three years, and the result is a hand-to-mouth policy detrimental to proper organization, efficient equipment and low-cost development. Prospecting should be kept far enough ahead to determine the advisability of driving long bedrock tunnels for exploitation or drainage.

The present Siberian actual, but not reported, cost of breaking gravel ground is often less than 75c. per cu.yd. even under the present method of mining and with working faces only 14 ft. long, which makes it more difficult to break than when long breasts are used.

Material is trammed in poorly made barrows, heavy to wheel, and having small wheels, and, as designed, most of the weight hangs onto the arms of the trammer. Much of the time, the distance wheeled is, as before stated, considerably more than 500 ft. With long breasts, cars and tracks, as used elsewhere, 3 cu.yd., should be mined per day per man at least, even assuming that the Siberian miner would break 50% less ground than miners elsewhere in similar deposits. In some California drift mines of my personal acquaintance, any man who usually did not break, load and tram to the main drift 12 carloads (8 cu.yd.) per 10 hours shift was marked for dismissal. Likewise in some of the California quartz mines I have had to shovel 12 tons per 10 hours into a car and tram to a chute. This often included considerable hammering on big pieces of quartz to reduce them to proper handling size. With the present Siberian method of skip loading, there are long delays in both tramming and hoisting.

Russian Timbering Practice Based on Ignorance

It is impossible to condemn adequately in terms the Russian timbering method, which often costs about as much per cu.yd. as breaking, tramming and loading into skip, or, in other words, more per cu.yd. than the total expense of mining similar gravel in other countries with labor two and one-half times as high. There is the entirely wrong idea that mine timbers must hold up all the ground to the surface, and the Siberian is careful about not piling tailings or pay gravel over workings for fear the extra weight will crush the timbers below. With such ideas as to the function of timbers, one can almost appreciate Siberian methods in general. Until this and similar childish fancies of ignorance are dispelled, and the Siberian is taught that the best way is to work the ground fast and encourage caving in worked-out places, rather than trying to support them, the present high timbering cost will prevail. No one thought, until recently, of installing self-dumping skips and ore bins.

Formerly, no washing was done in winter, though a little progress has been made in this practice. Gravel mined in winter was usually hauled to a dump, whence it had to be reloaded and rehauled to the washing plant in summer. Besides exposing rich gravel to theft —and full advantage is taken of this golden opportunity—a considerable amount of capital is tied up in storage piles. With winter washing, much of this rehandling could be avoided. Some day it will probably become the general practice.

The washing plants have been described, but it remains to be said that these are all situated right on the floor of the valley, usually in the lowest part alongside the stream bed, and, as a result, all oversize gravel from the trommels, and often much of the fine, as well, must be re-elevated by horse carts or machinery. With a properly designed plant, winter washing could be accomplished. If the washing plants were placed on adjacent hillsides, gravity water could be flumed or ditched to them, thus avoiding pumping and the extra handling of much of the oversize over 5 in. in diameter and all of the undersize. Greater economy could be accomplished in either or both of the following ways: First, use a bedrock tunnel with loading chutes, cars being loaded at long breasts and dumped into chutes, from which gravel would be loaded into main tunnel cars. Second, load main tunnel cars at breast and transport gravel without any other reloading through main tunnel. Then the cars could be hauled through tunnels, or hoisted up inclines or hoisted through vertical shafts to the surface, direct to the washing plant, situated on high ground, and the gravel washed with gravity water and the tailings would nearly all be thrown to waste by gravity. There would be only one shoveling and little handling.

Expense of Administration Should Be Curtailed

The unnecessarily expensive administrative department could be curtailed to advantage. Many of the Russian and some of the foreign staff are paid much more than men doing similar work in mines in other countries. A former manager received a salary and a percentage of the gross gold extraction, which resulted in the mining of much unprofitable ground, and his income from salary and royalty amounted, in some years, to about $100,000. Also, petty members of the staff, who have the Oriental idea that one loses one's "face" quite easily, have company horses and drivers to move them from place to place, often only a few hundred yards apart, for they are above walking. It is even beneath them to drive their own horses, thus necessitating horses and drivers. None of the administrative staff work hard; in places the offices close about noon and every one goes home to dine and sleeps part of the afternoon. Holidays, religious and civil, are most carefully observed. Cumbersome and inaccurate bookkeeping methods conceal, rather than reveal, necessary data.

Foreign Criticism Helpful

It is probable that there will be a lowering of costs, for the constant criticism by outsiders has at last awakened the Russian managements, and it is certain that almost anything that is done will result in improvement, for present mining methods could hardly be worse, and management could not be worse. At present gold stealing is encouraged at some mines, as it is thought to be good business policy.

Even with a proper appreciation of the mining methods, the poorness of management, methods, etc., which pen and camera cannot adequately picture, it seems hard to account for a cost of $8 to $9 per cu.yd. Before visiting the mines I could not understand how such a dismaying cost could be piled up, but, after seeing how badly mining was done, I could not understand how it costs so little. One has only to be familiar with drift mining in California and Alaska to realize that, with labor at less than $1 per day, a cost of $8 to $9 per cu.yd. is at least two and one-half to three times too much.

One result of the revolution will be to increase the effectiveness of labor. Formerly the laborer desired only food, clothing, shelter, vodka and cigarettes; the first three items being his necessaries; the latter his only pleasures. In the future he will demand more than mere necessaries and will insist upon other pleasures and sports, for with education the volume and variety of his wants will increase; but he will need a substitute for drinking vodka, which was his principal pleasure, but now prohibited and difficult to procure. Russians, either peasant or noble, do not know how to play.

The Gold Industry and Gold Standard

BY HENNEN JENNINGS*

Hennen Jennings states that: "The war is to be won by the efficiency, harmony and morale of the workers behind the firing lines as much as by the exercise of these qualities by the soldiers at the front. The right conception of what gold, and in fact money in any form, has the power of doing, or not doing, seems to me of most vital concern at present. A better understanding of this problem, I believe, would tend to knit together governments, labor and capital and make for efficiency, harmony and happiness."

GOLD attracted the attention of primitive man by its color, luster and indestructibility. The earliest mining and metallurgical operations of which traces remain were those in Egypt that dealt with the ores of gold. From pictorial rock carvings in upper Egypt, as also from Egyptian hieroglyphics, it is found that the search, desire, and use of gold extended back some 3000 to 4000 years before the Christian era. Starting with use as an ornament, gold soon became the trading counter, and has been an emblem of value to the human race as far back as history extends. Appreciation of the value of gold has been maintained through the centuries by the difficulties connected with obtaining the metal.

With early primitive methods, only the gold most abundant and easily worked and visible was first sought, and this was found principally in alluvial deposits; but as knowledge, mechanical skill and tools and appliances were developed by the human race, gold mining was extended to more difficult alluvial, vein, and lode deposits.

GOLD, THE COUNTER OF TRADE

Gold, when it became the counter of trade and a measure of possession, was the most eagerly sought of all possessions, and thus it became the pioneer and stimulant in mining, metallurgy and chemistry. The search for this precious metal became so intense that the alchemists sought its transmutation from other metals, which, though they failed to accomplish, won them other knowledge and gave birth to chemistry.

The trading value of gold has been stabilized by history in that no superabundance was ever obtainable, and it has always been necessary to expend labor and intelligence to an extent largely commensurate to the bartering value of the gold obtained.

Accurate records do not exist of the actual outputs of gold in early times, but certainly they must have been small from a modern standpoint. Great outputs of gold, as of all other minerals, are a matter of recent times. It has been officially estimated that the world production of gold since the discovery of America, in 1492, to the end of 1916, a period of 424 years, was $16,601,641,319. The output since 1894, a period of 23 years, was approximately $8,500,000,000, or slightly more than 50 per cent. of the total amount mined in 424 years. The average yearly production up to 1894 was $19,107,644, while since 1894 to date it has averaged $369,565,217 per year.

GOLD RESERVES

The available gold on hand as gold reserve in 1894 has been estimated at $3,965,900,000. The loss of gold and its absorption in the arts and manufacture of jewelry account for the difference between the amount produced and the amount on hand. The amount of gold used in the arts has increased since 1894, and of late years it has been between $50,000,000 and $100,000,000 a year. Estimating the consumption and loss of gold since 1894 at $2,000,000,000, the amount of gold at present on hand as gold reserve may be roughly estimated at $10,500,000,000.

The concentration and portability of this wealth can be appreciated by converting it into tons weight, for the total weight of the entire gold reserve of the world does not amount to over 17,000 tons, and it could be easily transported around the world in one of the largest steamships.

Gold and silver have advantages as money counters, owing to large value in small volume, ease of transportation, divisibility without loss, beauty, brilliant luster, great durability, ease with which they can be guarded, and the difficulty of counterfeiting. The province of the various mints of the world is to give guarantee of the weights and fineness of the gold they coin. The United States dollar contains 23.22 grains of gold and 2.58 grains of alloy, making a total weight of 25.8 grains, or 1.677 grams, and its fineness is 900. Gold coins of all nations, under normal conditions, are exchangeable on the basis of their fine gold content.

LARGE GOLD AND METAL OUTPUT RECENT

A broad outlook on modern mining and a study of the output curves of metals since the discovery of gold in California, in 1848; Australia, 1851, and Transvaal, 1886, indicate that big mining is surprisingly modern and that the great output of other minerals has been pioneered by gold. Until the last few years, gold outputs have shown a parallelism with those of coal, iron and copper; with the growth of railways, and the deposits in our banks. It would seem that the outputs of coal during the last 18 or 20 years; iron, 15 years; copper, 13, and petroleum, 11, were greater in the aggregate than the output of these minerals for all previous history.

The mineral outputs of modern times have been possible only by the advances made in invention, engineering, chemistry and business organization. Even so, it would now appear that the gold output of the world has about reached its zenith, and is giving indications of future decline, as shown by the returns for the last 10 years, given in Table I.

TABLE I. GOLD OUTPUT FOR THE LAST TEN YEARS

1908	$442,476,900	1913	$459,941,100
1909	454,059,100	1914	455,705,000
1910	455,239,100	1915	468,724,918
1911	461,939,700	1916	457,006,045
1912	466,136,100	1917	430,000,000(est.)

The extreme variation of outputs during this period is not great, but on the basis of the estimate for 1917,

*Consulting engineer of the United States Bureau of Mines.

a drop of 6 per cent. from the previous year is seen. Table II gives the gold returns from all countries of the world from 1912 to 1916, inclusive, with relative percentages for the pre-war year 1913.

Table II shows that gold has been mined in 60 different countries, and in all the continents of the world. It has been found in the oldest rocks, and thus in almost all subsequent geological formations. Traces of gold have been proved to exist in sea water, so the distribution of gold is most widely spread, but never in great quantity compared to other metals. Exceptional occurrence and favorable natural and commercial conditions are required for its profitable extraction.

TABLE II. WORLD'S PRODUCTION OF GOLD, 1912 to 1916, INCLUSIVE

(Compiled from the reports of the Director of the Mint, United States Treasury Department)

	1912	1913	Per Cent.	1914	1915	1916
North America:						
United States	$ 93,451,500	$ 88,884,400	19.3	$ 94,531,800	$101,035,700	$ 92,590,300
Canada	12,648,800	16,598,900	3.6	15,925,000	18,977,901	19,234,976
Mexico	24,500,000	19,308,800	4.2	19,308,800	6,559,275	7,690,707
Central American States	3,030,400	2,721,"00	0.6	2,293,800	2,970,271	3,517,597
South America:						
Argentina	107,300	2,600	0.0	2,600	.....	6,330
Bolivia and Chile	175,000	175,000	0.0	175,000	814,418	396,922
Brazil	3,570,600	2,254,700	0.5	2,698,200	2,424.515	2,424,515
Colombia	2,971,700	2,971,700	0.6	4,678,600	5,453,148	6,173,867
Ecuador	406,500	406,500	0.1	406,500	545,674	545.674
Peru	492,200	492,300	0.1	492,300	1,109,891	1,179,537
Uruguay	111,000	29,900	0.0	29,900	11,836	11,836
Guiana:						
British	879,800	1,353,500	0.3	1,126,500	923,892	767,525
Dutch	407,300	470,400	0.1	503,400	449,054	438,223
French	3,050,600	3,050,600	0.7	3,050,600	1,959,793	1,959.793
Venezuela	623,500	444,800	0.1	444,800	1,395,349	1,424,930
Europe:						
Austria-Hungary	2,043,200	2,179,300	0.5	2,179,300	1,392,465	1,392,465
Finland	.....	900	0.0	900	.....	.....
France	1,812,100	2,127,400	0.5	2,127,400	1,400,000	1,000,000
Germany	78,100	135,600	0.0	135,600	.....	.....
Great Britain	27,800	17,900	0.0	17,900	19,266	19,142
Greece	.....	.....	0.0	.....	.....	.....
Italy	11,000	17,200	0.0	31,100	2,295	2,295
Norway	.....	.....	0.0	.....	.....	.....
Portugal	2,300	2,300	0.0	2,300	661	661
Russia	22,199,000	26,507,800	5.8	28,587,000	26,322,746	26,322,746
Servia	251,100	328,000	0.1	116,000	.....	.....
Spain	.....	.....	0.0	.....	.....	.....
Sweden	20,300	17,600	0.0	17,600	25,323	25,323
Turkey	500	500	0.0	500	475	.....
Australia:						
British New Guinea	.....	377,200	0.1	377,200	.....	.....
New South Wales	3,416,900	3,093,200	0.7	2,573,800	2,738,958	2,235,556
Northern Territory	110,300	64,500	0.0	52,300	20,351	17,281
Queensland	7,192,700	5,493,200	1.2	5,134,800	5,161,911	4,447,793
South Australia	136,300	135,500	0.0	129.200	125.701	86,399
Victoria	9,925,200	8,990,800	1.9	8,541,900	6,802,359	5,305,282
Western Australia	26,514,900	27,165,700	5.9	25,487,800	25,014.928	21,941,044
New Zealand	6,428,100	7,102,700	1.5	3,870,700	8,740,567	6.048,992
Tasmania	785,000	690,400	0.2	542,500	383,402	326,408
Asia:						
British India	11,055,700	12,178,000	2.6	11,378,400	11,522,457	11,206,509
China	3,658,900	3,658,900	0.8	3,658,900	2,804,692	2,804,692
Chosen (Korea)	2,852,600	3,582,500	0.8	3,306,600	3,739,477	4,122,351
East Indies:						
British	1,352,000	1,352,000	0.3	1,352,000	3,100,000	3,100,000
Dutch	3,387,100	3,387,100	0.7	3,387,100		
Federated Malay States	.....	282,400	0.1	269,100	351,527	327,871
Formosa (Tiawan)	.....	814,600	0.2	814,600	1,143,017	1,001.178
Indo-China	74,700	74,700	0.0	74,700	43,659	65,620
Japan	4,467,000	3,614,400	0.8	3,614,400	5,386,066	5,386,066
Siam	56,500	56,500	0.0	56,500	.....	.....
Africa:						
Abyssinia	.....	497,200	0.1	497,200	.....	.....
Belgian Congo	.....	916,600	0.2	916,600	1,029,189	1,029,189
Egypt	.....	95,100	0.0	126,800	144,910	144,910
French Colonies	2,044,600	.....	0.0	.....	.....	.....
French East Africa	.....	.....	0.0	.....	43,414	43,414
German East Africa	.....	253,200	0.1	253,200	.....	.....
Madagascar	.....	1,256,200	0.3	1,075,900	1,381,354	964,980
Rhodesia	14,226,900	14,274,700	3.1	17,423,100	18,915,324	19,232,165
Sudan	.....	192,700	0.1	242,800	.....	.....
Transvaal, Cape Colony, and Natal	188,293,100	181,885,500	39.5	173,560,000	188,033,156	192,182,902
West Africa (Nigeria, Gambia, Gold Coast and Sierra Leone)	7,286,000	7,955,300	1.7	8,075,100	8,304,551	7,860,079
Totals	$466,136,100	$459,941,100	100.00	$455,676,600	$468,724,918	$457,006,045

Note. The percentages given are based on the 1913 production with normal mining conditions, when the Allies produced 91.3 per cent., the Central Powers .6 per cent., and the neutral countries 8.1 per cent.

The relative production of gold from all countries is given in percentages for the pre-war year 1913, and on a war basis the countries can be classified as Allies, Central Powers, and neutrals, with percentages as follows: Allies, 91.3%; Central Powers, 0.6%; neutrals, 8.1%. Of the Allies, it is seen that Great Britain, with her colonies and dependencies, produced 62.6%; the United States, 19.3%, and Russia, 5.8%. The principal gold producers of the world rank in order thus: Transvaal, United States, Australia, Russia, Canada, and Rhodesia. Australia's gold output from 1851 to 1903 amounted to approximately $2,060,000,000. The output in 1903 was about $87,000,000, and since then production has decreased gradually, until in 1916 it amounted to only about $39,000,000, or 45% of the production in 1903. There is at present no indication of any large increase of output in the future. The Canadian gold output was very small in 1891, but mounted rapidly until 1900, when the Yukon placer workings seemed to have reached their maximum; in that year the Canadian fields produced $28,000,000. Since 1900 there has been a fluctuating downward tendency. The years 1915 and 1916, however, showed some increase; the production for 1915 was $18,977,901, and that for 1916 $19,234,976. The war conditions are unfavorable for exploitation or search for new discovery. The extent of territory and natural conditions, however, are such as to give hope of greater future outputs.

Russia's gold statistics are open to doubt. It would

appear that gold has been worked in the Ural district since 1820 and that in the last 12 or 13 years outputs have varied from $35,000,000 to $22,000,000 per year. Some engineers express the belief that Siberia has greater possibilities for future discovery and exploitation of gold, as also of other metals, than any other field in the world. At present, in view of war and industrial conditions, the prospect of large outputs of gold in the immediate future is uncertain.

The South American and Central American Fields

Of these fields, Mexico is the most important. The revival of gold mining commenced with a very small output in 1890, and the maximum production was reached in 1911, with an output of $29,200,000. Owing to revolution in that country, the output in 1916 dropped to $7,690,707 which was a million dollars increase over 1915. When the country is in better political and economic condition, there is good ground for hoping for increased returns. In other sections of Central and South America the outputs have not been large, but there yet remain large stretches of unexploited territory and abandoned properties which may be found profitable to work.

Transvaal Production

The tabulated statement for the Transvaal, Table III, is given in full, as it is the most complete record of gold mining operations in the world. The yields, workings costs and dividends, from 1887 to 1916, a period of 30 years, have been obtained by sworn statements to both Boer and British governments. The total output for these 30 years was £492,198,901, or about $2,300,000,000. The yearly return for 1916 was £38,107,909, or about $185,000,000, which was 40 per cent. of the world's output for that year. The dividends amounted to 24 per cent. for the whole period, but only 18.6 per cent. for the years 1915 and 1916.

TABLE III. THE WITWATERSRAND GOLD MINING INDUSTRY'S PROGRESS

Official Statistics, Showing Annual Tonnage Milled, Value of Output, Working Costs and Dividends

Year	Tons Milled	Yield Total £	Yield Per ton s	Yield Per ton d	Working Costs Total £	Working Costs Per ton s	Working Costs Per ton d	Dividends £
1887	25,000	81,045	..	..	.....	..	..	12,976
1888	250,000	729,715	..	..	.....	..	..	109,050
1889	575,000	1,300,514	..	..	.....	..	..	430,666
1890	702,825	1,735,491	49	4	1,480,940	42	1¼	254,551
1891	1,175,465	2,556,328	43	5	2,221,630	37	10	334,698
1892	1,921,260	4,297,610	44	7¼	3,418,290	35	6	879,320
1893	2,215,413	5,187,206	47	0	4,231,848	38	4	955,358
1894	2,830,885	6,963,100	49	2	5,435,816	38	4	1,527,284
1895	3,456,575	7,840,779	45	4	5,793,927	33	5	2,046,852
1896	4,011,697	7,864,341	39	3	6,350,659	31	7	1,513,682
1897	5,325,355	10,582,616	39	7	7,876,435	29	6	2,707,181
1898	7,331,446	15,141,376	41	3	10,293,138	28	0	4,848,238
1899	6,639,355	14,093,363	42	3	11,606,968	..	..	2,946,358
1900	692,413	2,484,247	..	..	2,590,523	..	..	.....
1901	412,006	1,014,687	49	2¼	598,874	..	..	415,813
1902	3,416,813	7,179,074	42	0	5,057,948	25	9	2,121,126
1903	6,105,016	12,146,307	39	8	8,800,805	24	9	3,345,502
1904	8,058,295	15,520,329	38	6	11,664,359	24	4	3,855,970
1905	11,160,422	19,991,658	35	10	15,237,309	23	6	4,754,349
1906	13,571,554	23,615,400	34	6	18,049,431	22	2	5,565,969
1907	15,523,229	26,421,837	33	11	19,499,417	20	10	6,922,420
1908	18,196,589	28,810,393	31	5	20,273,620	18	0	8,536,773
1909	20,543,759	29,900,359	28	11	21,361,891	17	1	9,471,391
1910	21,432,541	30,703,912	28	6	19,487,807	17	7	8,876,085
1911	23,888,258	33,542,479	27	11	22,127,618	18	0	7,763,086
1912	25,486,361	37,182,795	29	0	24,504,700	18	8	7,952,994
1913	25,628,432	35,812,605	27	9	22,919,871	17	11	8,194,099
1914	25,701,954	34,124,434	26	6	21,945,692	17	1	8,073,436
1915	28,314,539	37,264,992	26	3	24,657,659	17	5	7,519,416
1916	28,525,252	38,107,909	26	8	25,763,270	18	1	7,095,066
Totals	313,117,709	492,198,901			343,248,445			119,029,709

There has been a great struggle to lower expenses, which have been reduced from 42s. to about 17s. per ton. The average yield has decreased from 49s. to 26s. It would seem that the Transvaal fields have reached their maximum output and are on the down grade.

The Rand gold mines are greatly favored in the fact that coal is found in close proximity to the gold. Also, native labor has been moderate in its wage demands, and outnumbers the white workers nearly 8 to 1, thus allowing skilled white workers opportunity for generous pay, which they have obtained.

Output of Rhodesia

The existence of gold in Rhodesia has been known for many years, but material gold returns started only in 1898, and steadily increased until 1916, when the output amounted to over $19,000,000. There was a falling off, however, in 1917, of nearly two million dollars. The total production from 1898 to 1917, inclusive, amounted to $194,672,165. At present the output is depressed by labor and supply conditions, and, although the territory for mining operations is vast, with still unknown possibilities, there have been no new discoveries of late.

The total production of gold in the United States has been given by the Director of the Mint in the following table:

TABLE IV. TOTAL PRODUCTION IN THE UNITED STATES

From 1792 to 1847	$24,537,000
From 1848 to 1872	1,204,750,000
From 1873 to 1916	2,599,670,200
Total	$3,828,957,200

The yield up to 1847 was obtained from the Eastern coast; from 1848 to 1872, largely from the placer mining in the West, and from 1873 to date by combination of placer and lode mining and the recovery of gold from refineries. Gold dredging in the United States dates only from 1896, and since that date the production of gold has been estimated at $120,103,117. In 1916 the greatest amount of placer mining, including dredging, was done in Alaska, where over 60 per cent. of the gold was thus recovered, and in California, where 38 per cent. was recovered.

The yearly production of gold in the United States, by states, from 1914 to 1917, follows:

TABLE V. YEARLY PRODUCTION OF GOLD IN THE UNITED STATES—1914-1917

State	1914	1915	1916	1917	Rank
Alabama	$12,300	$5,100	$7,000	$4,200	17
Alaska	16,547,200	16,710,000	16,242,000	15,171,300	3
Arizona	4,568,900	4,555,900	4,378,400	5,533,800	6
California	21,251,900	22,547,400	22,110,300	20,815,900	1
Colorado	19,902,400	22,530,800	19,009,100	15,955,100	2
Georgia	16,800	34,800	20,200	6,000	15
Idaho	1,187,200	1,170,600	971,700	711,500	12
Montana	4,143,600	4,978,300	4,575,400	3,756,500	7
Nevada	11,536,200	11,883,700	8,428,200	6,922,900	4
New Mexico	1,219,100	1,460,100	1,403,000	1,025,100	11
North Carolina	130,300	170,700	29,700	15,700	14
Oregon	1,589,400	1,867,100	1,901,600	1,677,400	9
South Carolina	3,200	3,600	300	1,100	19
South Dakota	7,334,000	7,403,500	7,512,200	7,392,600	5
Tennessee	6,400	6,800	6,000	5,300	16
Texas	8,800	1,800	500	900	20
Utah	3,377,000	3,907,900	3,593,400	3,620,300	8
Virginia	300	500	1,300	1,700	18
Washington	587,800	461,600	491,800	434,900	13
Wyoming	6,700	13,900	83,800	200	21
Other States	200	.....	.....	100	23
Totals	$93,429,700	$99,714,100	$90,765,900	$83,052,500	..
Porto Rico	2,800	700	600	100	22
Philippines	1,099,300	1,320,900	1,549,600	1,404,000	10
Totals	$94,531,800	$101,035,700	$92,316,100	$84,456,600	..

Although there are enumerated in Table V, 23 states from which gold has been taken, the first seven in rank have produced 89.62 per cent. of the total for the United States during the last four years. These states are, in order, California, Colorado, Alaska, Nevada, South Dakota, Arizona and Montana. Placer mining operations in 1916 produced about one-fourth of the gold output

of this country, of which 56 per cent. come from gold dredging.

All of the gold-mining corporations of the United States do not make public their yields, costs, or profits, as is the case in the Transvaal. Our Government does not make a demand for such information. Some of the largest and best managed, however, give most complete and generous information, which can be found in the transactions of mining societies, mining journals and handbooks. There would appear to be no reason for secrecy in gold-mining returns, as it is the one business in the world that does not face competition in marketing its product.

The richest and most easily accessible placer deposits in the United States, as elsewhere, have long since been worked out. Alaska is an exception, in that the discovery of placer gold there is of comparatively recent date and guarded by great climatic difficulties. Placer mining on a large scale started in this country with the discovery of gold in California, in 1848. The appliances and methods used were, first, the gold pan, followed by the rocker, long-tom and short sluice box; and subsequently by diverting water, shoveling and washing gravel into long sluices and working on a large scale; then drift mining, hydraulicking and gold dredging.

It has been estimated that an ordinary pan holds about 20 lb. and that from 45 to 100 pans a day is a good day's work. With a rocker, two cubic yards, or, say, three tons, is a good day's work. The cost of sluice mining depends on the character of the material, amount of water, grade of the surface, and climate, but it may be said to vary from 20c. to a dollar per yard in temperate climates. In Alaska, gravel is subject to a preparative cost for thawing, amounting to 20c. or more per cubic yard. Drifting, or underground mining of a thin stratum of gravel and the adjacent bedrock, varies in cost from $1 to $3 per cubic yard, and in Alaska as high as from $4 to $5.

Hydraulic, Dredging and Lode Mining

Hydraulic mining, or the concentration of water under great pressure on banks of gravel, with provision for the removal of the washed material and the removal of the gold, varies from 2½ to 12c. per cubic yard, and costs in Alaska up to 25c. Gold dredging was instituted to work gravel deposits that could not be economically worked by other methods. It can be successfully employed only when a great number of favorable conditions exist, in which case remarkably low costs rule, ranging from 4 to 9c. in California, and up to 33c. or over in Alaska. Lode or quartz mining in the United States and Alaska produces 75 per cent. of the output. For the world, the percentage is much larger. In South Africa practically all the output is from this source, and shafts as deep as 5000 ft. have been sunk on the Rand to develop the conglomerate deposits.

In the United States lode mining has been conducted in a great variety of formations, and the deposits vary from narrow veins of banded quartz, with high per ton yield, to great irregular masses of low-grade ore. The gold is often associated with tellurium and other minerals. When pay has given out at shallow or moderate depths, explorations to depths of 4700 ft. or over have very often been justified.

The treatment of the ores depends upon their richness and association with other minerals, and the processes for recovery mostly in use are the jaw and gyratory crushers, for the larger rocks; followed by stamp mills, ball mills or rolls, for finer crushing; then plate amalgamation, by which in certain ores the greatest gold return is obtained; and then concentration by vanners, shaking tables or oil-flotation devices. The concentrates are treated by smelters, chlorination or cyanide works. After stamping or amalgamation, the whole pulp is often economically treated in bulk by the cyanide process.

Variable Yields and Costs

The yields and costs vary in different districts and in different mines in each district. The greatest gold producers have been mines of low or moderate yield per ton, but with great mass occurrence and good conditions for economical working. The best example of such mining is the Homestake mine, in South Dakota, which has been worked since 1875, and has produced over $147,000,000, the ore not averaging over $4 a ton and costs ranging from $2.50 to $3 per ton, with dividends $40,000,000, or 27 per cent. of the output. The records of the Alaska Treadwell group of mines started in 1885, and brought up to June, 1916, showed there had been crushed and treated 26,000,000 tons, yielding $63,000,000 or $2.37 per ton, and at a cost of $1.42 per ton. The workings were extended to a depth of 2300 ft. Some of them were under the sea, and the majority of the mines were flooded with water on Apr. 21, 1917, and are now closed.

Lower yields and lower costs have been obtained by the Alaska Juneau Co. and the Alaska Gold Mines, which are only a few miles distant from the Alaska Treadwell Mines. Working on a large scale has only recently been started at these mines. In 1916 the Alaska Gold Mines crushed nearly 2,000,000 tons, giving a yield of 97c., and at reported costs of 73c. The Alaska Juneau's large mill has only recently been put into operation. It is anticipated their yields and costs will be still lower. These are the lowest yields and costs known in gold mining. Hydroelectric power is used, and all natural conditions are ideal for cheap working.

The Mother Lode in California, on which a 10-stamp mill was started in 1852, has been prospected or worked over a length of 125 miles, and has produced, according to estimates, over $230,000,000 in gold. At two of the mines, shafts have been sunk to vertical depths over 4000 ft. Many mines, however, have been abandoned at moderate depths, owing to failure to make them pay. The early returns per ton from the Lode were much higher than recently; now returns do not average over $4 per ton. Some old abandoned mines have lately been opened up again, and by hydroelectric power and a better system of mining and management have been made to yield a substantial profit.

A notable case is that of the Plymouth Consolidated Mines, in Amador County, on the Mother Lode, reopened after an idleness of 24 years, liberally equipped by capital and the operating costs reduced to about $3 per ton. The North Star Mine, in California, is a good illustration of a persistent but narrow vein of quartz, worked under good management, and being made to pay a moderate profit for a very long period. The mine was discovered in 1851, and since then to 1917 has

produced 1,470,000 tons, yielding $18,610,000, or an average of $12.66 per ton. The total dividends have amounted to $5,137,000, or about 35 per cent. of the yield. The returns for 1916 were $10.42 per ton, with costs at $6.26 per ton.

An example of very rich yield, but with short life, is found in the case of Goldfield Consolidated Mines, Nevada. Here, within eight or nine years, $50,000,000 has been taken out, but the yield fell from $38.50 a ton in 1910 to $7.52 in 1916. The costs must have been moderate, on account of the magnitude of the lode. The Portland Mine, in Colorado, is another rich telluride mine. It has produced over $40,000,000, with an average yield of $27 per ton. The dividends, however, have not amounted to over 20 per cent., as a great amount of development and costly mining and reduction have been necessary.

Effect of Economic Conditions on Future Output

In December, 1917, I was in California and Montana, where I had the opportunity of discussing with a number of operators, managers, and engineers the effect of the present economic conditions on the future output of gold and the proposed excess war profits tax.

As labor and supplies go up, so must the cost of winning gold be increased, and the purchasing power of gold decreased. An index as to the decreasing purchasing power of gold is obtained by noting some of the increases in cost of supplies used in its obtainment, some of which are given in Table VI. The advance in costs of hydroelectric power has been small. The cost of coal and petroleum varies in different localities, but where it is necessary to use these fuels, there is a serious advance in cost of operations due to increased power cost.

TABLE VI. PERCENTAGE INCREASES IN COST OF MINING SUPPLIES

	Per Cent.
Labor, about	20
Steel (in California)	40 to 280
Manganese steel (largely used in dredging)	130
Explosives	75
Quicksilver	93
Lumber	125
Machinery, etc	75
Miscellaneous	10 to 200

Some companies, with liberal margins between profit and loss, can continue to work under present or even much worse labor and supply conditions, but the excess war profits tax may so operate as to induce them to curtail outputs. Some of the mines working on very small margins are being closed down gradually, and others may be kept going for a time by reducing the development work and upkeep of plant, and generally marking time while hoping for better future conditions.

There has been a fear among operators that through the workings of the Priority Board there may be difficulty in obtaining transportation and other necessities to keep their mines in constant operation. The amount of tonnage that gold mining calls for from the railroad, where hydroelectric power is used, is very small, as the finished product of the mines is most concentrated. It would also work a great hardship in the gold-mining industry to close down the works and make the elderly and less efficient workers, who have not already been tempted by higher wages, seek employment and remove their families from the district in which they have spent a large part of their lives.

The excess war profits tax has been somewhat of a puzzle to many of the operators. The crux of the whole matter is how rightly to determine the rate per cent. earned on the invested capital; that is, the result of dividing the net income by 1 per cent. of the capital. If the rate obtained is between 7 and 9 per cent., there is no tax to be paid. If above 10 per cent., it progressively mounts until a taxation of 60 per cent. of all net profits can be imposed.

Difficulties at once arise in the interpretation of what is invested capital and what net income, and what are the legal deductions from ordinary income allowable before net income is ascertained. Invested capital may have an inflated showing in some system of accounts kept, while in others it may be over-conservative, in order to provide against the exhaustion of the mine. The interpretation of the returns and the bookkeeping of a gold-mining corporation becomes a most serious matter. It would seem from a reading of the law that a premium is placed on making a showing of high or inflated capitalization; also that large outputs and high yearly incomes are so penalized, and especially with low capitalization, that it would become a temptation to decrease outputs and take two or three times the usual length of time for mining the gold, as, when once mined, all hope for further profit of working is gone.

To illustrate, let us assume an invested capital of $1,000,000 and a net income of $1,000,000 in sight in the ground and with little hope of more, but which may be taken out in one or more years. What is the proper course for the management to recommend to its shareholders? If it is taken out in one year, the rate is 100 per cent., and the company must pay the Government $479,400. If in five years, the rate is 20 per cent, and the company would have to pay a tax equal to $23,900 by 5, or $119,500. If in 10 years, the rate is 10 per cent., and the company would have to pay a tax equal to $1,400 by 10, or $14,000.

Should a small group of miners or prospectors form a small company, of, say, $10,000 to $100,000 capital, and expend the entire capital, but strike it rich and take out as net profit an amount equal to or more than the capital put in—in such case, would they not be obliged to turn over to the Government nearly half of their profits? And, this being the case, is not the search for new gold discovery greatly discouraged by the tax?

It is my view that the elimination of all excess profit taxes on gold mining and the encouraging of maximum outputs might in reality bring in greater revenue to the Government than the tax; for larger dividends paid to shareholders would mean greater revenue from individuals.

The Gold Standard

Almost all the countries of the world have as their financial basis the gold standard. Only a few retain the double standard of gold and silver—Italy alone among the combatants. Prior to the war, while there was freedom in trade and intercommunication among the different countries, the prices of various commodities were regulated, both from within and without, by the operation of the laws of supply, demand, and competition, and stabilized by the intrinsic value of gold.

The debts of the principal belligerents at the time of their entering the war, and those contracted since their entrance, as also an estimation of further debts

per year, are given in a rough and approximate manner in Table VII. They are sufficiently accurate, however, to illustrate the danger of the world's financial situation.

TABLE VII. DEBTS OF PRINCIPAL BELLIGERENTS

Allies:	Pre-War	War	Total to Dec., 1917	Future Yearly Estimate
Great Britain....	$3,500,000,000	$23,350,000,000	$26,850,000,000	$10,000,000,000
France.....	6,346,000,000	11,754,000,000	18,100,000,000	4,400,000,000
Russia.....	4,544,000,000	16,300,000,000	20,844,000,000	(?) 5,000,000,000
Italy.....	2,900,000,000	6,300,000,000	9,200,000,000	2,500,000,000
United States.....	1,200,000,000	7,000,000,000	8,200,000,000	14,000,000,000
Total....	$18,490,000,000	$64,704,000,000	$83,194,000,000	$35,900,000,000
Central Powers:				
Germany...	$5,000,000,000	$20,650,000,000	$25,650,000,000	(?) $8,000,000,000
Austria-Hungary..	4,000,000,000	12,200,000,000	16,200,000,000	4,000,000,000
Turkey and Bulgaria...	800,000,000	1,100,000,000	1,900,000,000	350,000,000
Totals...	$9,800,000,000	$33,950,000,000	$43,750,000,000	$12,350,000,000
Grand Totals.	$28,290,000,000	$98,654,000,000	$126,944,000,000	$48,250,000,000

The table shows at a glance the great difference between the debts incurred by the Central Powers and those by the Allies. Taking into consideration the number of combatants and the necessary munitions and supplies used by them, is it not evident that the Central Powers are getting far more value for their debts contracted than the Allies?

In respect to the stock of gold on hand in the world and the amount held by the United States, used as money and security, the following quotation is given from the Report of the Secretary of the Treasury, 1917, page 24:

> The gold monetary stock (coin and bullion used as money) in the United States on November 1, 1917, is estimated at $3,041,500,000. The increase in the past 10 months has been $174,500,000; in the past three years $1,236,500,000, while in the past five years it has been $1,161,333,000. In five years the portion of the world's gold monetary stock held by the United States has increased from approximately one-fifth to more than one-third.

This indicates that the calculation of the gold reserve made previously in this paper corresponds closely with the estimate of the Secretary of the Treasury. Accepting $10,000,000,000 as the proper gold reserve of the world, it may be calculated that at the beginning of the war the gold reserve was 35 per cent. of the total debts of the principal belligerents, while at present it is only about 8 per cent.

Discussion of Gold as a Vital Force

When prices of labor and commodities are so advanced that it is not possible for the majority of the gold mines of the world to work at any profit, then labor and supply prices must become lower, or gold becomes automatically demonetized. Gold coins can be considered storage cells of human energy, as to obtain them labor of hand and brain must be expended; in fact, they are thus charged with human electromotive force. They are able to give out strong genial currents of trade confidence, circulating and binding trade, and bringing together different industries and peoples in different lands; their value is not founded on the fiat of any one or more legislative bodies of one or more countries that may be experiencing fleeting prosperity, but they are certificates from nature of man's work and accomplishment.

The electromotive force of the storage battery cells depends not only on the amount of the electricity poured into them, but also upon its pressure or intensity. In electrical parlance, the rate of flow is expressed in amperes, the pressure in volts, and the power in watts. In the gold cells filled with human energy, the amperes can be considered as the number of workers and the volts the forces and tools placed at the disposal of the workers by discovery, science, and organization. The watts may be considered the labor force stored in the cell or coin. In the mention of the labor elements poured into the cells, it must be understood that labor should include the work of managers, engineers, metallurgists, chemists, overseers, mechanics, and other skilled laborers, as well as the more unskilled work of drillers, trammers, shovelers, etc.

The electric storage battery of cells can be rendered useless or burnt up by excessive charges of current; they can also dry out and stop working, or be feebly active should there be an insufficient number of cells on the circuit to do the work demanded. Translating these conditions to the human electromotive coin cell, the value of gold can be destroyed by its too great abundance and its too great ease of obtainment. History is almost uncanny in showing how visions of superabundance, as seen or painted by owners and miners, have been doomed to disappointment, and how, considering time and averages, nature has demanded full toll in labor for her gold.

The electric storage cell can dry out and disintegrate unless refreshed with new current; this means that, should the obtainment of new gold cease while drafts on the old coins are vastly increased, the whole storage battery of gold energy may get so out of adjustment as not to do useful work, and gold would become demonetized and the accumulated labor energy of centuries past, locked up in old coins, become inert and valueless. Should all gold mining stop, or very radically diminish, this would be the result.

Cost of New Gold Supply in Relation to Wages and Commodities

As long as this country, or in fact any country, continues to measure values by a gold standard and pledge its credit on this basis, in the long run the cost of obtaining new gold supply must fix its limitations to the rise in wages and commodities. Gold is a sluggish governor, and seems at times inoperative, but its plentifulness and cost of obtainment is ever operative, though not the only factor in the rise and fall of prices. The real value of the gold coins is that they represent past labor achievements and cannot be duplicated in the future without equivalent labor effort. Promissory bills or notes, or contingent division of profits made by either governments, banks, or individuals, can be made mere scraps of paper almost overnight by war, revolution or commercial failure, but for thousands of years gold, while showing fluctuation in purchasing power, has ever been valuable.

Value of Securities and Bonds

Our Government securities and Liberty Bonds, pledged on a gold basis, take the place of gold coins only as long as the people in this and foreign countries have faith that the Government can make good its promises; when this is seriously doubted by the many, gold will go to a premium. The great gold reserves of the past would not be so necessary if the recognition of the fundamental necessity of measuring gold value

in units of labor necessary to win it were better recognized and insisted upon by governments that pledge their credit on a gold basis. Safely to lessen gold reserves while upholding the legal gold standard is the great financial problem of the day for this and other countries.

To attempt to adjust the value of the gold coin by changing its weight in fine gold by government fiat would be to take away all intrinsic merit from the gold standard and result in confusion and utter lack of financial faith and confidence. The temptation to enlarge obligations and thus reduce gold reserves to an inadequate amount, and to meet the difficulty by refusing to pay coin for gold pledges, also has great financial dangers. The conception and definition of money has been one of the most fruitful subjects of disagreement, argument and books known to man. It would seem, however, that the main functions of money are first, facilitating exchange; second, a means of estimating comparative values of commodities.

Value of Gold and Paper Money

The unreality of paper money is forced upon me by my study of gold, the happenings of the time and the outlook for the future. Money must in a large measure be based on sentiment and good faith, for money, even including gold, has no intrinsic value except as an incentive or stimulant to future human enterprise, effort and labor. Its stored value vanishes when the mass of the people repudiate it. When faith in it gives out, those that may seize and wish to make new divisions will find only waste paper in the bonds, notes and securities so eagerly desired and coveted.

Money can be converted into reality only by the working masses led by efficient officers, who not only make use of the muscular energy of the masses, but harness into service all the impersonal obedient servitors that discovery, invention, science and engineering have placed at the command of man, the force of which far exceeds all the muscular energy of man.

The payers of income tax in 1915 did not amount to more than one-third of 1 per cent. of the population. The envied rich amount to only a fraction of this number. They may enjoy pride of possession in the paper showings of their bank deposits and lists of securities, and also the power it gives, but their absorbing power of that which money can really give to them individually is very small and confined largely to what they and their families can eat, drink and wear. All other possessions they must share or pass on to others. The rich are merely deflectors, gates or valves in the energy currents. The greatest wealth by the individual has been obtained by organizing labor and producing the necessities of the many at the lowest prices and taking small profits per unit, but with the greatest number of units.

Labor and Wealth

As labor in its broader sense has been organized and stimulated to produce a maximum amount of commodities, it provides for its own necessities and comforts as well as that of the few, and makes possible a greater division of such commodities among the workers. Thus, great production is beneficial to the many as much, and in proportion more, than to the few. The decennial census of 1910 shows that above 93 per cent. of the male population of the United States over 21 years of age is occupied in gainful pursuits. A far more difficult problem than the destruction of capital would arise among the workers should the present order of things be suddenly abolished—determination as to how a fair, satisfactory, stimulating division of salaries and wages could be arranged and enforced among the workers, so that they would have more leisure and at the same time more wants and necessities.

Any advance in wages of one class of workers must in fairness be followed by proportionate increases in the wages of other classes, and as the laborer's wants and requirements for subsistence and comfort are dependable on his fellow worker, so must the cost of his subsistence increase as his own and other wages are raised. Thus, in the end no material gain can be obtained by the laborer unless there is some corresponding advance in the output of his work.

The Government at the present time is the greatest employer of labor and purchaser of commodities. The danger of allowing the prices of commodities to rise above the future cost necessary for obtaining gold, it is hoped has been made plain. Certainly the Government should insist on the stoppage of all classes of profiteering; but how is it possible to fix prices of any commodity and make low bids possible unless there is some limit fixed upon wages and salaries?

The war must be won, and it will take money as well as men to accomplish it. However, it does not help matters to pledge credit unnecessarily to please or placate either labor or capital, and the more we get for money on a gold basis at the present time the less will be the burden of debts incurred on future generations, which must of necessity be paid by the mass of the people rather than by the few.

Gold Production Interfered with by High Cost of Labor and Supplies

The financial integrity of the country has been pledged on a gold basis. As 91 per cent. of the gold output of the world comes from the Allies' territories, as a war measure it is plain that it is to the advantage of the Allies to uphold the gold standard. For the last 10 years the world's yearly output of gold has been almost stationary, and the present high costs of labor and supplies are acting very seriously against any increased production. To stop gold mining in a time of financial stress, as has been indicated, would be like closing the doors of a bank when a run is made upon it. It therefore must be evident that it is vital for this and all Allied countries to encourage gold mining as far as possible.

Excess War Profits Tax Especially Injurious to Gold Mining

Unfortunately, but little help can be directly extended to the gold industry, but, as far as possible, encouragement should be given, and the excess war profits tax placed upon this industry should be reconsidered, for while the war may have proved profitable to every other class of industry in the matter of earnings, certainly it has been seriously injurious to the gold industry. Indirectly, the gold industry, as well as new issues of Liberty Loan Bonds, can be greatly helped by the reduction in prices of all necessary commodities, and this

certainly should be seriously, judiciously and fairly taken in hand by the Government.

The war is to be won by the efficiency, harmony and morale of the workers behind the firing lines as much as by the exercise of these qualities by the soldiers at the front. The right conception of what gold, and in fact money in any form, has the power of doing or not doing, seems to me of most vital concern at present. A better understanding of this problem, I believe, would tend to knit together governments, labor and capital, and make for efficiency, harmony and happiness.

Charles M. Schwab

Charles M. Schwab's recent appointment as Director General of the Emergency Fleet Corporation, to have charge of the building of ships to win the war, had an electrical effect on Washington, where it was regarded as epoch making in our war progress, said the *Times*. Of all the appointments made at the Capital since the declaration of war, there had been no parallel to this.

President Wilson, in calling upon Mr. Schwab, violated precedents long indorsed by public opinion. Mr. Schwab is building more ships for the Government than any other man in the country. The companies which he controls are turning out probably more than one-fifth of the ships now being supplied to the Government. This fact is important in itself, of course, but it has a particular interest because of the recent report of the Senate Committee on Military Affairs, recommending that, in the reorganization of the Aircraft Board, no aircraft manufacturer should be in direct charge of contracts and purchases.

"That means," said an industrial leader at Washington last week, "that no man who knows a business shall be placed in charge of it. It is a question of production, not restriction. The nation's very life as a free people rests upon getting the best possible man. Who is the best man but he who is most interested in the business, who has shown that he has the ability to produce more than any other man? The time has come when the patriotism of the men most needed by the country must be trusted."

The President has asked the man most interested financially in shipbuilding to take charge of shipbuilding at a crisis in the history of the country. Mr. Schwab, as his record shows, knows how to build ships. All other considerations had been dropped into second place. The demands of war necessity, according to the views of everybody of intelligence nowadays, require that the best qualified men be appointed and trusted. The *Times* quotes the following Washington opinion of the appointment:

"Mr. Schwab is to have a free hand. There is a difference between an executive and an administrator, a distinction not yet clear in Washington. An executive, as I understand it, is a man who sees that orders are carried out. He knows how to handle men and affairs to that extent—no mean ability. An Army officer of the old school often made an admirable executive, as a bureau head. An administrator has this ability, but in addition he has creative power. It is that which makes a business grow, which extends a little plant over one acre after another until it has a payroll of 50,000. It requires latitude of operation, swing. There is no other kind of business ability like it. In its highest form it is genius. In this country at one time there are not likely to be a dozen such men. They are the greatest asset, in one way, that the country has. Schwab is one of them. I am glad we are going to use him. You can vote big bond issues, but you can't vote a Schwab.

"We have suffered in this war from ideas we held before the war as to the Government's function. Our Government watched over business and industry as a sort of umpire, imposing restrictions on competitors to see that they played fair. But we don't realize, at least we are slow to realize, it seems, that the Government has gone into industry itself, that it is trying to become one big war industry. Production, not regulation, is the heart of our business now. The great thing is to increase that production, as the little plant was increased until it had a payroll of 50,000. Now, a man has to be producer to do this in the best degree; he can't learn it from another man, nor get it in a college degree, not in the Schwab form. When you call a man to a task of production there is just one test—what has he produced? How great an establishment has he been able to keep going? How many payrolls has he been able to take care of every Saturday night? What is his output?

"A man who wins remarkable success in a particular business usually knows it from the ground up. He then can tell himself, if anything is going wrong, why it is. That has been a handicap, as I see it, to Mr. Hurley and Mr. Piez. If there was a disagreement between two ship men as to whether a thing could or could not be done, it was necessary to refer the matter to some one well acquainted with shipbuilding. But when such a question goes up to Mr. Schwab he can say: 'I know it can be done that way, for I have done it myself.' Just so, when a job ought to be finished, he knows himself, because of his vast experience. He knows the principle of handling an immense organization; that is, holding the chiefs whom he appoints responsible. He will not have lesser questions referred to him for decision; it is a mark of inefficiency to refer something to him which should be decided lower down. Not details, but the totals, the results, tell him everything."

Increased Refining of Bolivian Tin Ores in Chile

According to cable advices received by the Bureau of Foreign and Domestic Commerce from Commercial Attaché William A. Montavon, at Santiago, Chile, the Llallagua tin smelter recently erected at Arica, Chile, is now working on a small scale, its total production to date being 30 tons of metal of 99.8% purity and free from arsenic and antimony. The smelter comprises one reverberatory, one liquating, and one roasting furnace, with a monthly capacity of 1000 tons of barilla, producing approximately 650 tons of metal. California petroleum residuum is used for fuel. An additional reverberatory and an additional roasting furnace are now under construction, which will increase the capacity of the plant to 1500 tons of barilla in about two months, when the present Llallagua contract will have expired.

Mining Manganese at Crimora, Virginia

By Marshall Haney*

It is within the last four years that interest centered around the manganese deposits of Virginia, bringing them again into prominence. This is due to conditions in the market which have resulted in an increase in the price of manganese ore to such a degree that the mines can be operated at a satisfactory profit. About 40 years ago Virginia produced nearly all the manganese then mined for the steel industry in the United States. Practically all of this ore came from one mine, the Crimora, in Augusta County. After the mines had been in operation for a number of years under the supervision of the Carnegie Steel Co., litigation started, which has for more than 20 years prevented operations at Crimora. During this period of litigation many small deposits in the valley were operated in a small way and made for their owners excellent profits.

Early Operations

Small washers were erected and the ore was mined by opencut and tunneling over an area of 80 acres or more, and to a depth ranging from 10 to 75 ft. No effort was made at that time to recover the fines and the lean ore, the large boulders and stratified ore only being taken out. After a number of years of this kind of mining, several hundred thousand tons of clay impregnated with a small percentage of manganese surrounded the workings, and the mine was left in an exceedingly bad condition.

The property was purchased by the present owners, the Crimora Manganese Corporation of New York, in 1914. The company owns 1200 acres, but not all of it is manganese bearing. The manganese area is confined to a basin lying between the foothills and the Blue Ridge Mountains. At this point the basin is wide, and was formed by the tilting of the Potsdam formations. The manganese minerals were leached from the rocks of the Blue Ridge and redeposited in the basin.

Later Development

The first operations were undertaken with the object of securing definite information relative to the tonnage that was still in place within the basin. Keystone drills were used, and at present over 100 drill holes have been put down to the Potsdam beds, indicating a thickness of the ore-bearing clays of from 150 to 275 ft. and an important ore tonnage. A complete record of this preliminary work, together with samples and analyses of all drill work, has been carefully kept. An average analysis of the ore is given in the following: Manganese, 58.24%; iron, 0.58%; silica, 1.92%. The manganese percentage is equivalent to 89.72% of manganese dioxide. The ore is high grade and is sold to the chemical trade at an average price of $90 per ton.

A drag line excavator has been installed in the opencut. It is equipped with a 1½ cu.yd. Scofield bucket and has a capacity of 125 tons per hour. From the opencut the ore is transported to the washer by means of an incline gravity railroad, on which two 4 cu.yd. side-dump cars are operated. From the cars it is dumped into the main storage bin, at the head of the mill. The material is discharged from the bin over stationary grizzlies, the bars of which are three inches apart. The fines are delivered into a 25 ft. McLanaham stone washer. The oversize is received on a moving grizzly, the bars of which also are spaced three inches apart, and then deposited into a drag conveyor. The drag conveyor carries the large lumps to a slugger roll crusher. Here it is crushed to three inches and sent to a log washer. Leaving the washer, the material passes into a revolving screen, No. 1, perforations of which are two inches. The undersize passes to screen No. 2 (perforations ¾ and 1 in.). The oversize of No. 1 screen is elevated to a picking table, where the gangue and iron minerals are removed and the clean ore finally received in the ore bin. The oversize from No. 2 screen is handled in the same way. The undersize of No. 2 screen is passed over No. 3 screen (perforations $\frac{3}{32}$ in.). This screen acts as a slime screen, removing all of the slimes before the material is elevated in two sets of four-compartment McLaughlin jigs. The mill comprises two separate units, each a duplicate of the other. Some ore is lost in the undersize of screen No. 3, and it is planned to install an additional unit to recover this.

Another washer and crushing unit having a capacity of 30 tons is now being constructed. The mill, as designed and installed, has a capacity of 1000 tons per 10 hours, and the washing facilities, 100 tons of washed ore. The main milling plant is in three sections, each of which is 66 x 150 ft. The equipment is modern and electrical power is used for operating the plant. The entire equipment cost about $200,000.

*Consulting mining engineer, Geer, Greene County, Virginia.

John D. Ryan

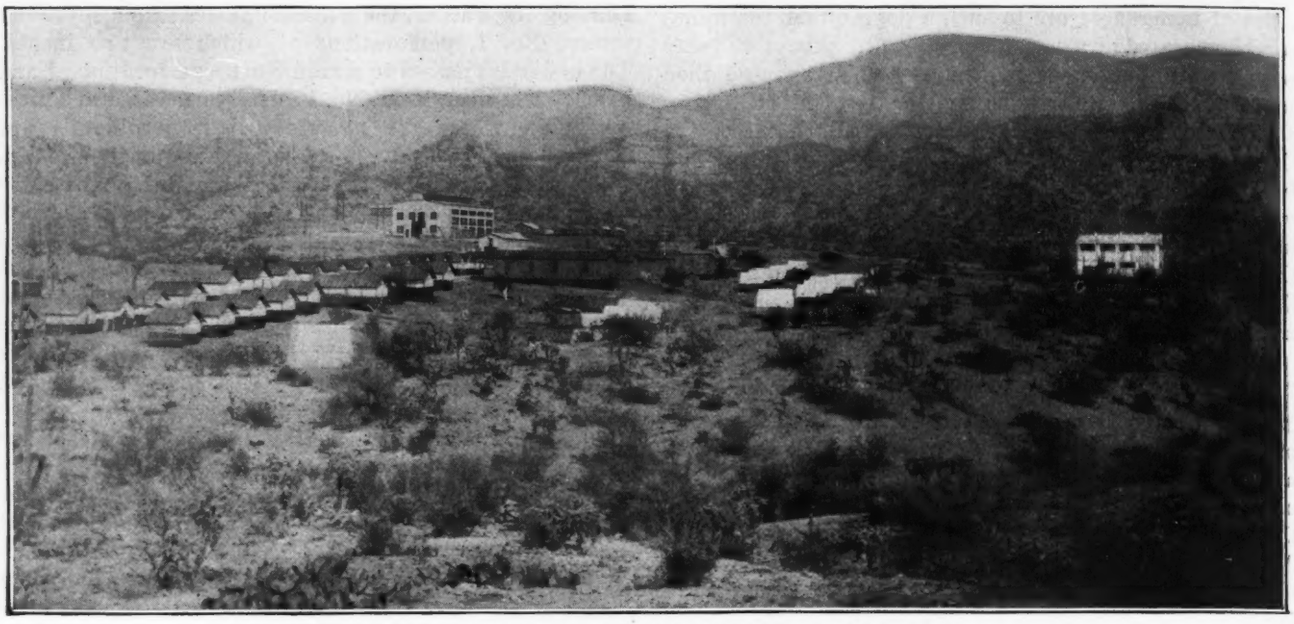
John D. Ryan, one of the country's foremost business organizers and industrial mobilizers, is best known for his work in connection with the Anaconda Copper Mining Co., of which he is president. His reputation as a leader in the financial world was founded chiefly on the remarkable administrative ability displayed in the rejuvenation of the Anaconda company and later in his development of the Montana Power Company.

During the last year, however, Mr. Ryan has been continuously in the Government service, first as Director General of Military Relief of the Red Cross. He has had complete supervision of maintaining the base hospitals at home cantonments and in military camps abroad.

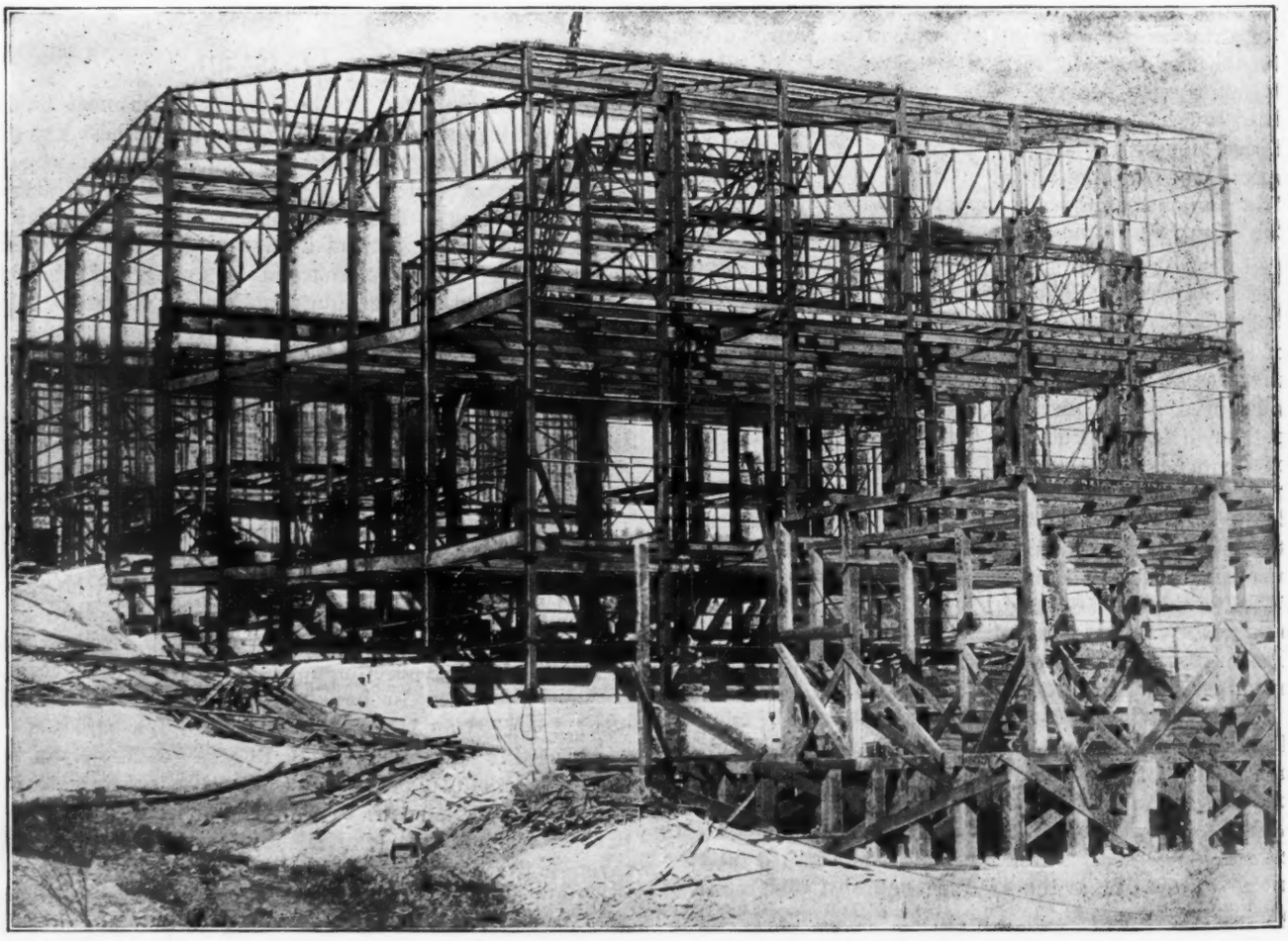
Mr. Ryan was born at Hancock, Mich., Oct. 10, 1864. He grew up in the Lake Superior mining region, but, according to himself, never did any mining. Early in his teens he became a traveling salesman, and he first came in touch with the interests which afterward became the Amalgamated mining group while selling oil in Butte, Mont. There he met Marcus Daly. Mr. Ryan became interested in banking, and after Mr. Daly's death acquired an interest in certain of his banks.

About this time, 1904, H. H. Rogers got Mr. Ryan to look after the Amalgamated Copper Co.'s interests in Montana. His job was to reconcile the differences between warring factions. His success was soon displayed through the purchase by the Amalgamated of most of the Heinze properties. Then he came to New York on Mr. Rogers's invitation, succeeding to the presidency of Amalgamated soon afterward.

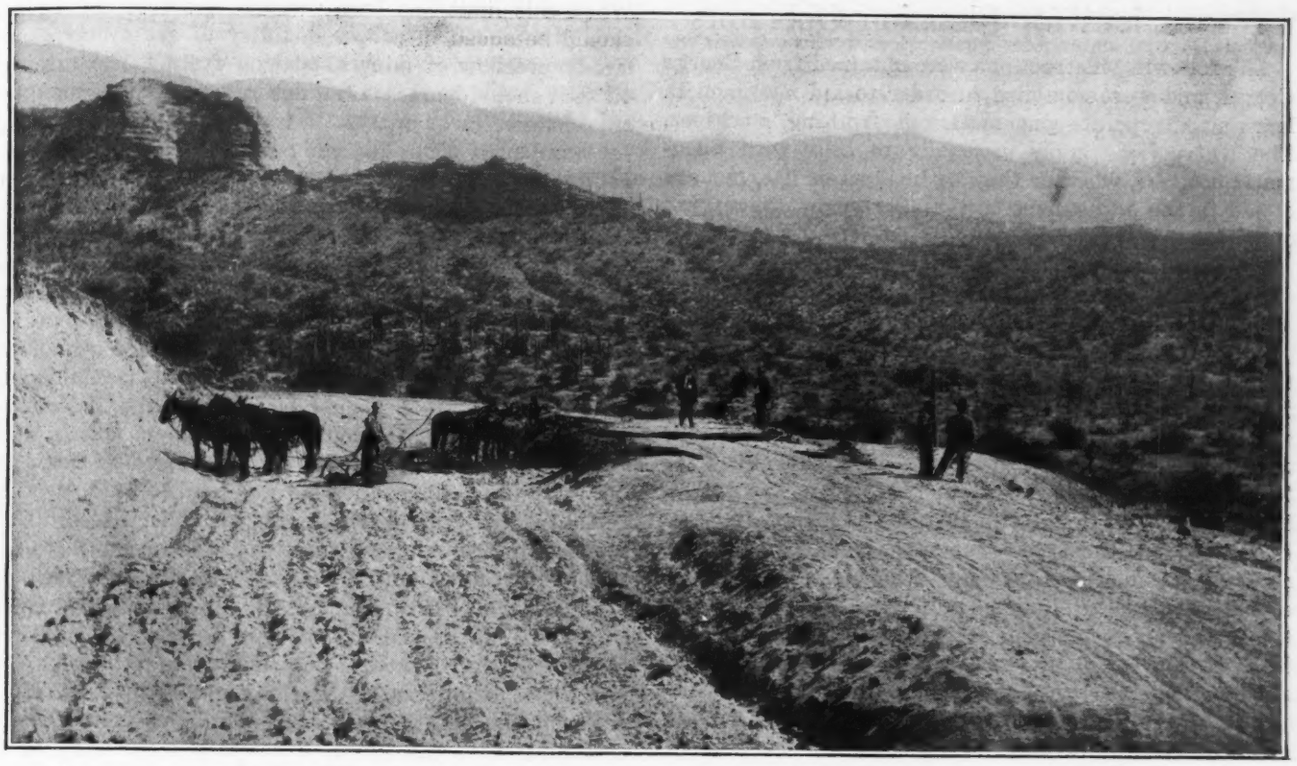
Mill Construction in Arizona



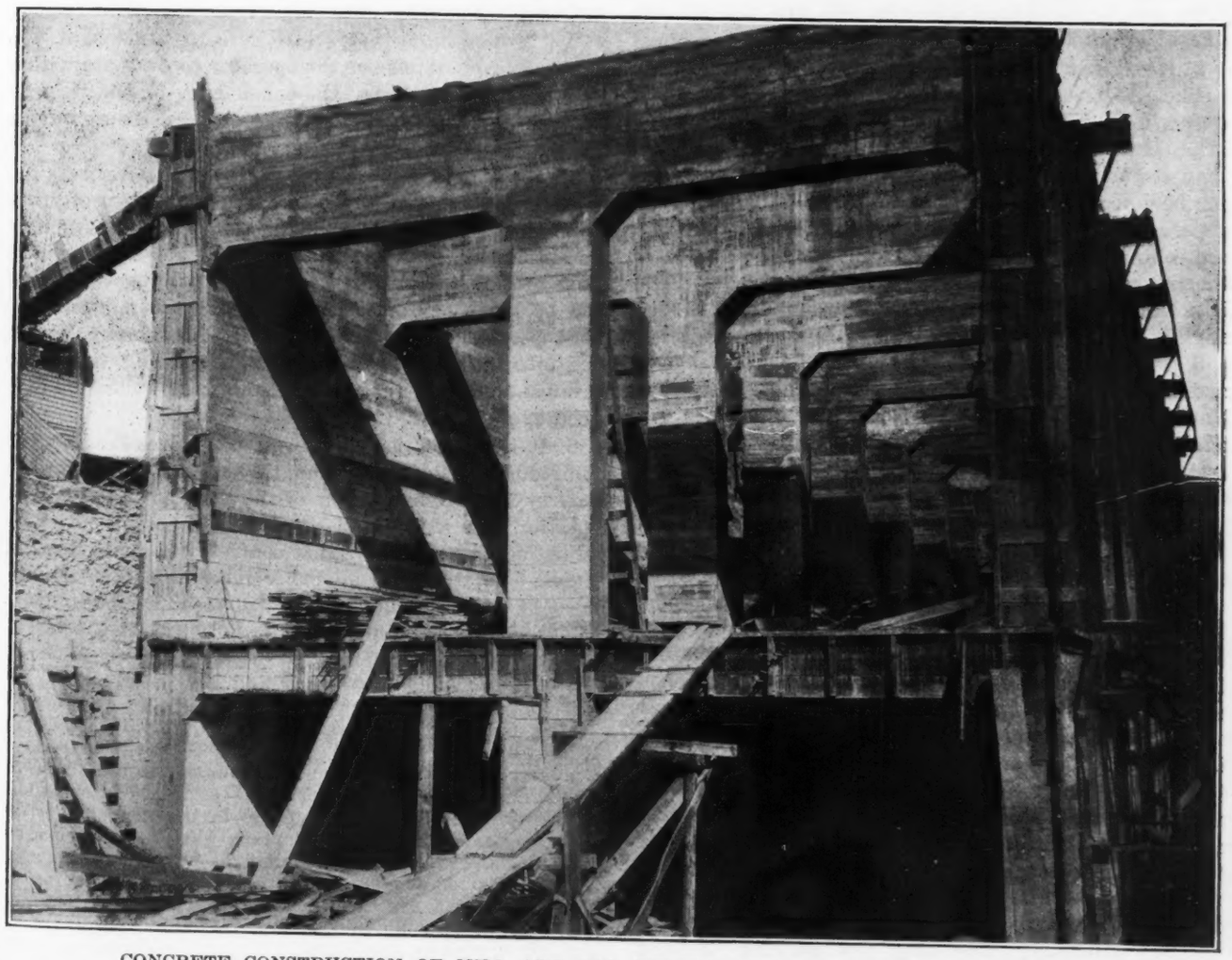
MILL SITE, BELGRAVIA, ARIZONA-HERCULES COPPER CO.



STEEL FRAME, MILL BUILDING, BELGRAVIA, ARIZONA-HERCULES COPPER CO.



GRADING FOR MILL AT BELGRAVIA, ARIZONA, ARIZONA-HERCULES COPPER CO.



CONCRETE CONSTRUCTION OF MILL ORE BIN, BELGRAVIA, ARIZONA-HERCULES COPPER CO.

Instructions for Flotation Operators

The following instructions were obtained from George Crerar, and were compiled in order to aid new men in learning to operate pneumatic-cell frothing machines. The instructions apply especially to cells with pneumatic bottoms, whether they be inclined or flat, but are of aid in the adjustment of the oil feed in other types of flotation machines.

1. In starting up a flotation plant be sure all pump and elevating equipment is working properly before the pulp is admitted to the system. Turn the air on at all pneumatic machines before the pulp enters. Prior to this, the opening given the valves should have been determined by filling the cells with a little slime pulp and pine oil and turning the valves to the different cells until the proper amount of air has been determined for the formation of a good froth. In setting the valves, it is a good plan to tie a small piece of lacing or twine into the hand wheels, so that subsequent adjustments, necessary from time to time, can be facilitated. Occasionally it is well to start the pulp with an easily assimilable frothing agent, such as Pensacola No. 80 pine oil, G. N. S. No. 5 pine oil, or Cleveland-Cliffs No. 2 hardwood creosote. Then when a good froth has been obtained on the regular ore pulp, the "priming" oil can be cut out, and the regular frothing mixture to be used, cut in. In all subsequent experimentation in regard to change of oils it is well to make the changes gradually from one to another unless the oils are entirely incompatible in their nature.

2. Never increase the oil feed rapidly, as over-oiling is likely to result before it is realized. Free oil in the cells will kill the froth. An inexperienced operator may increase the oil on a charge already containing more oil than it can assimilate under the conditions. Free oil can be detected by the odor and by the distinctly greasy appearance of the little froth that may form, while when over-oiling has become great, froth will be absent over the greater part of the pulp surface. A sputtering effect is noticeable in the froth surface when the pulp is only slightly over-oiled.

3. The froth on under-oiled pulps is generally brittle and flat. The bubbles break with slight explosions. Vapor may be noticed when the larger bubbles break, and there is a tendency toward a slight spray. The mineral load in froths that are under-oiled has a tendency to gather in masses and then sink.

4. The feed of too much air to a pneumatic cell will cause "blubbing," that is, the formation of air vents through the body of the froth. Too much air has a tendency to kill the froth or else to reduce it materially in volume, so that it may stop overflowing. "Blubbing" and the formation of air vents indicate either that too high an air pressure is being carried under the pneumatic mats, or that the mats are covered with coarse sand, or are leaking. Too much air, dirty mats or leaks in the mats will increase the grade of tailings.

5. After the air valves have been set so that approximately the same amount of froth is being made over each air compartment, the quantity of the froth that overflows from the machine can be controlled best through regulation of the frothing agent. Ordinarily as much air should be fed to the pneumatic bottoms as is possible without producing "blubbing" or blowing through. When this limit has been reached, the frothing agent should be added in proper quantity to get a maximum steady overflow of mineral-bearing froth. The rate of oil feed should be measured, not guessed, before making any changes in quantity. If the oil is added in drops, the number of drops fed per minute should be counted. If it is flowing in a stream, a graduated cylinder large enough to hold the supply that is fed during one minute should be used, and the quantity caught noted before altering the feed. When the quantity is known, the amount can be increased or decreased by the amount that experience has indicated to be advisable, but in making changes it is better that they be made gradually than in large variations. In deciding upon a change, the "rougher" froth should be used as the indicator. An increase in the amount of "rougher" froth will generally mean an increase in the oil carried by the tailing from the cleaner, and this will tend to build up the amount of frothing agent in the "rougher" feed. Because of this pyramiding effect, it is always well to be cautious in the amount of change made in the oil feed.

6. Both the quantity and quality of the froth will vary with the pulp consistency so long as other conditions remain the same. A thin pulp will generally produce a wet, fast-flowing froth. A thick pulp will produce a dry, tenacious and sometimes a voluminous froth, which is difficult to break down, and which may carry over considerable amount of gangue. After a few samples have been taken in a graduated cylinder and weighed, and then the pulp in the sample dried and weighed again, so as to determine the ratio of ore to solution, it will generally be possible for the operator to estimate with a fair degree of accuracy the consistency of the pulp by noting the amount of sediment that settles in the cylinder in an hour.

7. The only way to get clean tailings is to operate the pneumatic machine so that the proper quantity of froth is coming over the sides all the time. Troubles should be anticipated and preparations made for dealing with them while they are developing, so that the equipment can be repaired or the necessary changes made in the least possible time. Less time will be thereby lost in the operation of the plant. High running time, low tailings, and high-grade concentrates are indicative of a good operator.

8. It is a good plan to permit the valves feeding the individual pans of the pneumatic bottoms to be adjusted only by the foreman or one of the shift bosses—the best flotation man in the mill—and then to confine all other adjustments to the valve that controls the air-feed main. Unless operators are all experienced, constant adjustment of the individual valves will result, and the operating efficiency of the cell as a whole will, in all probability, be greatly lowered.

Mica Exported from Brazil increased from 1435 kilos in 1910 to 15,348 kilos in 1914, and to 53,743 kilos in 1916, says *Commerce Reports*. The principal sources are the states of Bahia, Sao Paulo, Goyaz, and Minas Geraes. In Goyaz, the most important deposits are found in the municipality of Meia Ponte. In Sao Paulo, deposits have been discovered in Bananal, Itapecerica, Paranahyba, S. Bernardo, and Juquie. Extraction has been stimulated by the increased demand for mica, especially for use as an insulator for electric materials, for automobile tops and as an absorbent of glycerin in making dynamite.

Zone System of Fuel Distribution

The U. S. Fuel Administration, under its zoning plan for distributing fuel, will issue permits for the shipment of coal for special purposes to points outside the zone in which the particular coal desired originates. The purpose of this zone plan is to save transportation by the elimination of unnecessarily long hauls and avoidable cross hauls, thereby conserving the car supply and increasing car utility. This should result in an increased production of coal.

The zones apply only to bituminous and cannel coals and do not apply to anthracite or coke. Embargoes under the plan affect shipments of coal in any class of car equipment and were put into operation jointly by the U. S. Fuel Administrator and the Director General of Railroads on Apr. 1.

It is recognized, however, that some consumers will require, for illuminating or producer gas, byproduct coking, metallurgical, smithing or other particular purposes, special coals which are not produced in the coal districts from which the zoning plan permits shipments to be made. Such requirements will be cared for by permits issued by the Fuel Administration upon proper evidence that the request for such permit is warranted. Forms may be obtained from the U. S. Fuel Administration, and applicants should be governed by the following instructions:

All applications for permits must be addressed to the U. S. Fuel Administration, Coal Zone License Bureau, Room 6209, New Interior Bldg., Washington, D. C. They must be made by the consumer, stating in detail the necessity for the special coal and the amount required during the period for which permit is requested. In case of a consumer having more than one plant, or requiring special coal from more than one producer, separate applications for permits will be required for shipment from each producer as well as to each plant. Separate applications for permits will be required for each railroad on which shipments originate. Permits are revocable at the discretion of the Fuel Administrator.

The general effect of the zone system is to restrict eastern coal to eastern markets and fill the vacancy in the Central and Western states with near-by coal produced in those states. As an indication of the saving to be effected, the movement of more than 2,000,000 tons of Pocahontas coal to Chicago and other western points over a haul of about 660 miles will be eliminated. Chicago can obtain this tonnage of coal, and under this system must obtain it, from southern Illinois mines, with an average haul of 312 miles. Allowing for differences in quality in the two coals, there will be thus saved 11,400,000 car miles, or, very conservatively figured, 285,000 car days. This will permit 14 additional round trips of 20 days each from West Virginia mines to zone destinations, making possible an additional production of at least 700,000 tons of Pocahontas coal.

Similar comparisons show that on the movement of 550,000 tons annually from Kanawha districts to Wisconsin points there can be saved about 2,500,000 car miles, with a consequent increased production of about 300,000 tons. On the movement from southeastern Kentucky to Chicago the saving will be about 800,000 car miles and 50,000 tons production. The elimination of the Indiana to Iowa movement will save 1,600,000 car miles and permit 100,000 tons additional production. These are only a few of the instances of transportation saving possible.

Bituminous coal the movement of which is regulated by the zone system is about 300,000,000 tons, or 60% of the total production. Based on this production, there will be saved on the round trip from and to the mines almost 160,000,000 car miles. This, it is claimed, will permit the same cars to make almost 300,000 additional trips from the mines, equivalent to an increase of 5% in the production. The increase in total production in 1917 over 1916 resulting from all efforts was about 8 per cent.

Electric Smelting of Phosphate Rock

Electric-furnace smelting of phosphate rock and the use of the Cottrell precipitator in collecting the volatilized phosphoric acid are described by J. M. Carothers in *Journ. Ind. and Eng. Chem.* for January, 1918. The tests made were a continuation on a commercial scale of preliminary work which was carried on more than a year ago. They were made possible only by the coöperation of the Bureau of Soils with several firms interested in this line of investigation. The apparatus was installed near the plant of the R. B. Davis Co., at Hoboken, New Jersey.

The plant as erected was a 200-kw. installation. The incoming power was ½ phase, 2400 volts, which were transferred to 3-phase, 220 volts by a bank of Scott connected transformers. A second bank of transformers and a set of double-throw switches made it possible to have either 220 volts or 110 volts in the furnace. This arrangement was adopted so as to use the higher voltage for starting and the lower voltage for operating. For the best operating conditions, 110 volts was found satisfactory.

The furnace consisted of a water-cooled crucible, with a cooled section extending no higher than the region of the molten slag. It was lined with fire-clay brick. The part not exposed to the action of the slag was also lined with the fire-clay brick, as were all gas mains and the cooling tower. The electrodes entered through the top of the furnace. Six-inch and 4-in. graphite electrodes were used. The life of a 4-in. electrode was about seven days, while the 6-in. electrode lasted an average of 10 days, under favorable conditions. During regular operations about 2000 lb. of rock were consumed per 12-hour period. In these experiments the charges were set by hand.

A slag pit filled with water was used to quench the molten slag as it flowed from the furnace. The slag, thus chilled, slid to one end and was removed mechanically. The P_2O_5 content of the slag was approximately 2%, although it is possible to reduce it to 1.5% or even 1% for regular operation. The P_2O_5 content is largely a matter of mixing the charge and using the proper proportions of rock, sand, and coke.

The average production was 0.3 lb. H_3PO_4 per k.w.-hr. absorbed. As the gases were removed from the furnace, they passed through a cooling tower before entering the treater. The temperature of the gases on entering the treater was from 250 to 300° Centigrade.

Power was supplied the treater from a 150-volt motor generator set, and transformed to higher voltages by a 7.5 k. v. a. transformer. It was found that 70 kilovolts was sufficient to give complete precipitation of the gases. In designing the treater, complete clearance

had been given to 2000 cu. ft. of gas entering at 300° C., with a velocity of 3 linear ft. per sec. The concentration of the acid as collected was controlled by the temperature of the gas in the treater.

When a rock free from dust is used the only impurities likely to be in the resultant acid are carbon in the form of coke dust, silica dust from the sand and rock, and any volatilized fluorine or arsenic which is absorbed in the acid as the gases pass through.

Based on 0.3 lb. H_3PO_4 per kw.-hr., a 3000 kw. furnace would produce 21,600 lb. H_3PO_4 per 24-hr. day. On this basis the cost of acid per lb. H_3PO_4 is 2.55c. or 3.37c. per lb. P_2O_5 for power, labor and materials.

Tin Trade Advised on Tin Shipments From Pacific Coast

Circular letter No. 4 was issued to the tin trade on Apr. 13 by the subcommittee on pig tin of the American Iron and Steel Institute. It deals with shipments of pig tin from the Pacific Coast and reads as follows:

A letter has been received from A. G. Young, chairman, subcommittee on traffic conditions, American Iron and Steel Institute, which is quoted in full for the information of the trade, as follows:

> The greater part of pig tin moving from Pacific Coast is being consigned from Pacific Coast ports of entry to New York, and after reaching New York we are asked to assist consignees in obtaining permits for shipment from New York to various points in the West, particularly in the Pittsburgh district.
>
> With conditions at present existing, New York terminals being practically blocked, it appears to be a burdensome method of handling on the part of the railroads, as well as being expensive to the tin owners.
>
> Effective at once, we are notified by the roads reaching New York that no further shipments consigned to New York will be accepted, unless permits are first obtained by consignees, so it would appear necessary to adopt immediately some method of handling and forwarding from Pacific Coast ports, including Vancouver.
>
> The present rate on pig tin from Pacific Coast to New York is 56.2c. per 100 lb. The rate in returning from New York to points in the Pittsburgh district is 15.1c. per 100 lb., making the extra expense for handling pig tin to New York and return to Pittsburgh district $90.60, based on the weight of 60,000 lb. per car.
>
> The present rate to Pittsburgh from the Pacific Coast is 56.2c. per 100 lb., and from Pittsburgh to Chicago 45c. per 100 pounds.
>
> Both in the interest of conserving transportation, avoiding double haul to New York and return, and also to effect a considerable saving in freight rates, recommendation is made that further shipments of Pacific Coast pig tin be consigned either to Chicago or Pittsburgh for clearance at either one of these two points, an additional reason making this necessary being that shipments to New York can be made only on permits to be secured by consignee in advance of shipments going forward from the coast.

It is recommended that all importers, dealers and consumers arrange, if possible, to have their shipments passed through the custom house at the Pacific Coast port of arrival. If for any reason this cannot be done, it is suggested that all shipments destined for consumption in the Middle West and the vicinity of Pittsburgh be shipped "in bond" to Chicago, Pittsburgh or other convenient interior port for distribution from such points.

The present practice of bringing shipments for interior points through "in bond" to New York should be discouraged, as it causes congestion at New York terminals and results in great delay in the delivery of this much-needed material at consumers' plants.

Moreover, the back haul from New York to Pittsburgh on a carload of 25 tons (56,000 lb.) involves an extra cost of the freight from New York to Pittsburgh at 15.1c. per 100 lb., equivalent to $84.56.

The Institute and the subcommittee on pig tin will coöperate to the fullest extent possible with the trade in facilitating the release of shipments at interior points.

Concentration of Molybdenite Ores in Ontario*

The concentration of molybdenite has been one of the most difficult problems in ore-dressing. This has been due in part to the high molybdenum content demanded by the market and in part to the character of the mineral. For ores which contain no bismuth or copper, the standard of the market is too high for the best interests of the industry, as the demand is for concentrates that will carry from 90 to 95% MoS_2. In case of ores from eastern Ontario, it would be more equitable to base quotations on 70% concentrates. The impurities in these concentrates are either sulphides or silicates, principally pyrite and pyrrhotite, or pyroxene and mica. In use, the concentrates are either introduced as sulphide into the furnace or roasted to convert the molybdenite to molybdic acid. In the first case, pyroxene and mica would be removed in the slag, while the pyrite and pyrrhotite would furnish a source of iron for the manufacture of ferromolybdenum. In that case the value of the concentrates should be based on the molybdenite content, and the iron values should be added.

In case the molybdenite is to be roasted, these accompanying minerals are of no value, but are also harmless, and are removed with little difficulty in the subsequent leaching of the roasted mass.

Hand-Sorting Precedes Crushing

As a preliminary treatment of the ores, it is customary to pick out by hand large flakes, as the loss in crushing, rolling and screening of this type of material is comparatively large. In all concentrating mills, the ore is reduced to a size that will pass a 20-mesh screen. Extremely fine grinding is not desired in most cases, as that portion of the rolled material which passes through a 60-mesh screen is found to carry an almost negligible quantity of molybdenite. In consequence, the best results will probably be obtained by crushing and rolling the ore to pass a 20-mesh sieve, and passing this material over a 60-mesh screen to remove dust, thereby lessening the load on the concentrator. Detailed descriptions of well-known concentrators are not given here, except where some new feature has been introduced.

At the Spain mill owned by W. J. Spain, of New York, and situated at the Spain mine, in Griffith Township, Renfrew County, the power is furnished by two 60-hp. boilers. The engine is in the mill building. Before being brought to the mill, the large flakes of molybdenite are picked out by hand, and the rock containing the smaller material is then put through a jaw crusher. From this point it is carried on a picking belt, where flake molybdenite and waste rock are removed, to a set of rolls which reduce it to about one-half inch. It is then conveyed on a second picking belt to a second series of rolls. The fine material is then dried in a steam dryer and bolted, after which it is further concentrated by a Hooper pneumatic concentrator. This represents the practice in the early part of the summer of 1917. During the summer, however, a modification was introduced in the form of a Wood machine.

The mill of the Renfrew Molybdenum Mines, Ltd., was in course of construction during the summer of 1917.

*Excerpted from account of A. L. Parsons, Ontario Bureau of Mines Report, 1917.

It was the intention to use the Elmore vacuum concentrator. As a preliminary, the ore was to be crushed and put through a ball-mill to reduce everything to a fine state. These fines were then to be mixed with a certain amount of oil and put through the concentrator, whereby the sulphides would be removed as heads, while the remainder would go off as tails.

Practice at International Mill at Renfrew

At the plant of the International Molybdenum Co., at Renfrew, the ore is first put through a gyratory crusher, which reduces it to an inch-mesh, and is then elevated to large rolls. The product of the rolls is screened, and the oversize returned, while that portion of the remainder which will not pass a 20-mesh screen is passed through a second set of rolls, the oversize being returned to these. The pulverized ore is then taken to a concentrator devised by the manager, G. P. Grant, a description of which follows:

It consists of a wooden vat about 12 ft. long in which a series of boards or baffles is placed at right angles to the direction of flow of the water. Several types of feed have been tried, two of which have proved more successful than the others. For very fine material, a gentle blast of air blows the ore over the surface of the water, and as the current of water carries this material over the baffles the surface tension is altered, so that the more angular pieces sink, while the ffaky material remains on the surface. The material thus floated is received in a tub provided with a screen which permits the water to escape, while the concentrates are retained. These are then dried on a steam coil.

For coarser material, the distribution on the surface of the water is accomplished by a rotating drum covered with cloth, the material being distributed on the drum by a conical feed. The larger fragments sink before reaching the first baffle plate, so that this material is screened to recover large flakes of molybdenite. The rest of the operation is the same as that described above. From this concentrator it is usual to get a product running from 65 to 80% MoS_2 without further treatment. In case a higher grade is desired, the product is cleaned by screening the finely rolled material, which removes the more angular fragments of pyrite and quartz that may have come over, while saving the flaky molybdenite. No acids or oils are used in the concentration, the principal prerequisite to the successful concentration being that the material shall be dry.

Department of Mines Testing Molybdenite Ores

A large portion of the testing plant of the Mines Branch, Mines Department, was devoted during 1917 to the concentration of molybdenite. The general plan of procedure was to crush the ore in a jaw crusher, after which it was passed through rolls. At the time of my visit a ball-mill was being installed for finer grinding. The finely pulverized material was fed to a modification of the Wood flotation machine, but since then the operation has been considerably changed, and wet crushing is now possible. At the time of the visit, the ore was fed to the surface of the water by means of an endless apron, and the gangue sank, while the molybdenite remained floating. With the molybdenite a considerable quantity of pyrite and other minerals continued to float, and this was then taken on another apron and re-deposited on the surface of the water. The portion that still floated was drawn off as concentrates. This was further treated by being dried and re-floated so as to remove the iron sulphides which were the principal impurities in the molybdenite after passing over the concentrator. In the modified machine which was described by G. C. Mackenzie before the Royal Canadian Institute, the endless aprons have been removed and the ore is fed directly on to the surface of the water, and the breaking of the surface tension is brought about by jets of water from below the surface.

Accidents in 1917 at Butte & Superior

The accident record at Butte & Superior for the year 1917 shows that 32.93% of the total accidents underground were from falls of ground. Although this is a reduction of 2.47% under 1916, it is more than double the percentage of accidents from any other cause, and this phase of "safety first" cannot be brought too strongly before the eyes of every man working underground, writes C. K. Bain in the *Spelter Journal.*

The decrease of accidents caused by falling ground for 1917 under those of 1916 is gratifying. In 1917 the number of accidents per 10,000 shifts was 0.577, compared to 0.788 in 1916, a decrease of 27%. This decrease is attributed to a great extent to the use of carbide lights, these having replaced candles in the mine early in 1917. A carbide light gives more light and the range of illumination is greater, so often one can see at a glance a loose rock which he could see only by careful observation with a candle. When using a candle a man walking along a drift or floor of a stope will invariably hold it close to the ground to see where he is walking, and it gives little or no light on the back and therefore no chance to detect a loose rock, which might fall and injure him. The one significant conclusion to be drawn from the above statistics is: The increased lighting of a working face has brought about, to a certain degree, the conditions the "safety-first" movement has been endeavoring to instill in the minds of the underground man, viz.: Observe your working place and see if it is safe.

One form of accident which is caused indirectly by loose ground is when a man has not cleaned his flooring before starting to bar down at the breast. If a large amount of rock is loosened and he steps back to get in the clear, he falls through or possibly stumbles and takes chances on falling in a chute.

A man is often careful enough of his own safety, but doesn't give enough consideration to the safety of others. This is illustrated by a miner working on the floor above the mucker and neglecting to warn the mucker when he bars down a single piece of loose rock, thinking it will be of no consequence. A good-sized rock will glance or roll off a pile of ore, hitting the mucker and possibly breaking his leg. Sometimes the miner has all good intentions but shouts "Look out below!" after the article is on its way, not giving the man below time enough to heed the warning. The "safety-first" movement cannot be a success in this case, or in any other, without the coöperation of each and every man underground, so let every one pull together.

Remember the Comfort Fund of the 27th Engineers.

Correspondence and Discussion

Heap Leaching of Copper Pyrites

Metallurgists generally are much indebted to the Phelps Dodge Corporation for that company's readiness in permitting publication of the details of its technical operations, showing a marked contrast in this respect to the attitude of the Rio Tinto company.

It is not, however, easy to follow G. H. Van Arsdale's contribution in the *Journal* of Feb. 2, because the results of preliminary experiment and the reasoned conclusions which he derives from them seem to have been altogether departed from in the large-scale trials. Iron salts behave in rather a peculiar way as oxidizers and reducers. A ferrous solution will precipitate metallic silver from salts of the latter, becoming ferric in consequence, and a ferric solution will dissolve metallic silver undergoing conversion to ferrous in the process. The apparent contradiction is explainable by the laws of mass action. Ferrous and ferric salts mixed in certain proportion would not effect either a silver salt or the metal. While the behavior of iron salts in this way depends a good deal on the nature of the substance on which they act, it may be stated in a general way that the presence of ferrous salts always impedes the oxidizing action of a ferric solution.

In the working process described, the effect of circulating the solution through the heaps via the precipitation launders is obviously to reduce its solvent action on the pyrites. That it has any action at all is due to the small amount which does not drain off and undergoes partial oxidation in the slowly drying heaps. I suggest that extraction might be much quicker and more complete if the solutions draining from the heaps were aërated, say in a Pachuca vat, acidified to the extent found necessary, and returned to the heaps, this cycle being interrupted only when it was desired to obtain a supply of cement copper, when perhaps after a preliminary circuit or two without aëration, etc., the solutions were pumped to the precipitation launders. The conversion of a ferrous to a ferric salt by free oxygen is normally accompanied by increasing basicity; that is, basic salts or hydrates are produced, which are generally insoluble. The addition of acid in due proportion overcomes this disagreeable feature.

It is peculiar that the chart illustrating the behavior of Burro Mountain ore shows a marked falling off in the rate of extraction following the first addition of acid in September. On the other hand, Table VII —which, I take it, relates the assays of the liquors before and after passing through the precipitation launders, though they are described as to and from the heaps—shows that, in this month, the amount of copper in solution was considerably greater than in preceding months, and that it was precipitated by replacement with iron with much greater economy of the latter, judging from the relative decrease of copper and increase of iron in the solution. Some explanation of this anomaly would be welcome.

A method of precipitating copper from solution which I should like to see tried out is based on the following reaction: When to the solution of a copper salt is added a solution of the pyrosulphite salt of an alkali (known to photographers as metabisulphites), a dirty reddish precipitate of cupro-cupric sulphite forms, which on boiling changes to a brilliant vermillion granular precipitate, which settles instantly. Sulphur dioxide is copiously evolved. Pyrosulphites are produced by crystallizing out solutions of the ordinary acid sulphites at boiling point. With the exception of tin, none of the ordinary metals is affected, as far as I know. As sulphur dioxide is generally available about a copper plant and lime is cheaper than iron, it ought to be worth a trial.

R. T. HANCOCK.

4 Stanley Gardens, Alperton, Wembley,
Middlesex, England, Apr. 4, 1918.

"Colorimetric Determination of Bismuth"

Referring to the article on "Colorimetric Determination of Bismuth," by H. A. B. Motherwell, which appeared in the *Journal* of Dec. 22, I found practically the same method that he describes in use at Elliott's Copper Works, Burryport, South Wales, in 1906, where it had been practiced for several years. It was used there principally for controlling the quality of wire bars for export, and speed was a consideration, which led to the development of a mode of procedure somewhat more rapid than that described by Mr. Motherwell. As I remember it, the method was as follows:

A suitable quantity of the copper to be analyzed is weighed out into a 500-c.c. flask, and, after being taken into solution with nitric acid and diluted with water, a measured quantity of lead-nitrate solution is added and an excess of ammonia and ammonium carbonate. The precipitate of lead, containing all the bismuth, is allowed to settle at a moderate temperature until the supernatent liquid is clear, when the whole is filtered through a double filter. By alternate washing with ammonia and hot water, the precipitate can be quickly and completely freed from copper, and when this is accomplished the paper is opened out on the funnel and the precipitate washed back into the original flask by means of a fine jet of water, and there dissolved in acetic acid (1:1), pouring the latter over the filter paper to dissolve the last traces of precipitate. When all is dissolved, cool, and dilute until the flask is nearly full. Prepare the necessary standards in 500-c.c. flasks and add potassium iodide either in crystals or solution. Mix well by giving the flasks a swirling motion and compare the shades. I believe the comparison will be found to be easier using flasks than when Nessler tubes are employed.

The solutions should be cold before adding the iodide, and I would emphasize the necessity of having only a

small quantity of bismuth present in the sample weighed out for analysis, preferably not more than 0.00015 gram. If larger quantities are present, the depth of color is such as to make exact comparison difficult. At Burryport, where the bismuth present in wire bars rarely exceeded 0.0004%, 20 grams were taken for analysis, and no difficulty was found in estimating the Bi, even when only 0.00015% was present.

W. T. PHILLIPS, Chemist.

Fundicion "La Tortilla" Linares, Province de Jaen, Spain, Jan. 31, 1918.

A Dietary for Miners

Of course we anticipated that our article on dietetics might draw something from the feminine side, but we are gratified when it is as complimentary as the following, which we publish that our male readers may know how our work was received by a capable housewife and able executive:

"You are some cook! For a man that is not a nice lady-cook, you know a stupendous amount. I can see no reason why the article is not perfectly practical, and it certainly is far-reaching and scientific. Perhaps the greatest praise I can give it—and this is not meant in egotism, although we are apt to take our own ideas as being the proper standard—is that I could see nothing to add nor change. I can imagine a manager of a big mine turning the article over to his efficiency man and saying, 'Here, go over this with the cook and tell him to conform to it in the kitchen, with the help of the purchasing agent.' I believe mine boarding houses could still make a fair profit by charging more in camps where the wages are better, as in Arizona.

"I do not know how your subject will strike the sort of people that you would like to interest. The fact that you have applied food conservation principles to miners makes it at once available to those who are seeking efficiency along other occupational lines. However, I think you have done amazingly well, and the article is broad, timely and valuable. Now you had better write a purely scientific mining article, or they will think you are only a cook." C. R. B.

Nevada City, Calif., Apr. 6, 1918.

Fine-Grinding and Porous-Briquetting of Zinc Charges

It was with much interest that we read the letter of Parker C. Choate in the Mar. 23 issue of the *Journal* upon the subject of fine-grinding and porous-briquetting of the zinc charge. We agree with him in noting with some curiosity how slowly the advantages of zinc-ore briquetting appear to penetrate the technical conservatism of the spelter industry. In this respect the same inertia is apparently as marked in the United States as it is in England. More than 18 years ago, we patented and advocated the method of briquetting treatment for fine ground zinc and complex zinc ores, and a paper embodying our results was read before the Institution of Mining and Metallurgy (London) in 1900, in which the advantages that Mr. Choate shows it to possess were stated as follows: (1) Greatly increased furnace capacity, and correspondingly reduced working costs per ton of ore; (2) low zinc content of briquette residues, and (3) applicability of briquetting to lead-zinc ores, and lack of damage to retorts, etc.

This process is referred to by W. R. Ingalls in "Metallurgy of Zinc," page 650, while its successful application to the direct production of good-grade spelter from fine zinc-lead flotation concentrates (Broken Hill) was the subject of an article by Theodore J. Hoover in the *Journal* of Aug. 13, 1910.

As all patent interests have lapsed long ago, we may be acquitted of an interested motive in referring to past work on these lines. If, as we are often told, the zinc retort during the next few years will have to put up a stiff fight with its electrolytic competitor, it may as well do so to the best advantage. This we still believe will be found to lie along the lines of briquetting. The readiness with which American metallurgists recognized our work in "froth flotation" is in contrast with their slowness to appreciate a minor, though unquestionable, advance in the technics of spelter production. SULMAN & PICARD.

London, England, Apr. 12, 1918.

Development of Community Interest

Western metal mines have struggled with the conditions discussed by Charles F. Willis, in the *Journal* of May 4, for a long time and without making substantial headway until recent years. The necessity for rapid development, the relatively short life of the western mine, the restricted capital available, the frequent remoteness of the locality and the newness of the communities that have sprung up have contributed to prevent any but the larger companies from undertaking work of this kind. The adventurous character of the population attracted to a mining camp has been another obstacle. Development of community interest is, also, properly not a problem for the mine management, but one for the community itself.

Experience has shown, however, that the community does not show much inclination to undertake its duty in this respect, and it therefore falls upon the management to assume the leadership. Thus the engineer in charge of a property is confronted with the community problem as well as engineering problems. The adaptability of the mining engineer is thus called upon to meet a severe test, for he has usually given little attention to sociological matters. Many of the communities are too small for the support of an elaborate organization. It therefore seems to me that under such circumstances mining companies should employ an experienced worker in sociology and direct their efforts in fostering community interest and welfare in accordance with his recommendations. The work is of importance, not only in large but also small communities. While the larger communities possess greater potentialities for carrying on this work, once it has been well started, than the smaller ones, both require considerable attention at the start. However this attention may be given, immediate steps should be taken for the development of leaders from among the workmen and citizens of the community itself. They should be given every opportunity to assume the responsibility for the management of the enterprises undertaken. By thus shifting the responsibility where it belongs, on the community, a more successful outcome may be looked for.

New York, May 6, 1918. ENGINEER.

Company Reports

Annual Report of U. S. Smelting, Refining and Mining Co.

The United States Smelting, Refining and Mining Co. in its report for 1917 states that the increased cost of production of each of the metals, due mostly to high cost of labor and material used at mines and plants and to higher prices paid for custom ores, offset any increase in the average price realized during the year. The report shows operating earnings of all companies of $5,769,390.74, from which allowances for depreciation and exploration reserve and depletion reserve amount to $1,571,575.72, leaving net profits for the year of $4,197,815.02. From this, additional reserve, taxes and war contributions of $692,500 were allotted, dividends paid on the preferred stock of $1,702,225 (7% per annum) and on the common stock of $1,755,575 ($5 per share), and $47,515.02 was added to the previous surplus of $12,957,454.96, leaving an undistributed surplus as of Dec. 31, 1917, of $13,004,969.98. Metals produced during 1917, including metals produced from custom ores and the production in Mexico, amounted to:

TOTAL METAL PRODUCTION U. S. SMELTING, REFINING AND MINING CO.

Copper lb.	29,043,242
Lead lb.	107,519,570
Zinc lb.	53,590,446
Silver, oz.	13,000,187
Gold, oz.	109,612

The average prices at which metals were sold during the year were: Copper, 27.201c. per lb.; lead, 8.558c. per lb.; zinc, 9.353c. per lb., and silver, 81.765c. per ounce.

Ores produced from Centennial-Eureka, Mammoth Ritz, Tennessee and Bingham mines, and in Mexico, totalled 1,129,678 tons, of which the values of the metal contents were in the proportion of 28% copper, 10% lead, 13% zinc, 39% silver and 10% gold. The output of coal for the year was 908,638 tons. The Bingham mines shipped 85,402 tons of copper ore and 120,669 tons of lead ore. The extensive improvements during 1916 enabled a better extraction and an increase of underground development. The Utah smeltery, at Midvale, operated to capacity throughout the year, and no new large installations were made. Centennial-Eureka mine extracted 50,132 tons of ore, most of which came from the vicinity of old stopes. Owing to the unfavorable condition of the spelter market, all zinc-smelting operations, with the exception of Checotah smeltery, were discontinued. At the Mammoth mine, the Friday Lowden tunnel reached a length of 7500 ft. and the Sutro 29 tunnel a length of 2500 ft. Both of these tunnels have been used as a basis for exploration work and good orebodies have been opened up. At the Stowell mine, south of the Mammoth, stoping operations were started. The smeltery at Kennett operated through 1917, and 345,990 tons of ore were treated, including siliceous ores used for fluxing. The electrolytic zinc plant for treating bag-house dust from the smeltery began operations during the year. Operations in Mexico were continued under difficulties of transportation and supply of materials. Underground work was done on a normal scale, and more ore was developed than the available mills could handle.

Annual Report of Ray Consolidated Copper Co.

The report of the Ray Consolidated Copper Co. for the year 1917 shows net profits available for dividends of $9,701,169.74, or $2,015,258.27 smaller than 1916. This was equal to $6.15 a share on 1,577,179 shares of stock ($10 par), as against $7.42 a share earned in 1916.

The total ore mined from all sources was 3,621,233 tons, containing 1.681% copper, and was an increase of 7.7% over the tonnage in 1916. Net mining costs were $1.04 per ton, an increase over the 1916 costs, which were 69.12c per ton, and due to increased cost of supplies and higher wages. Total ore milled was 3,560,900 tons, containing 1.635% copper and giving a recovery of 74.53%, equivalent to 24.37 lb. of copper per ton. The gross production of copper from all sources amounted to 92,207,356 lb., an increase of 18% over 1916 production.

The comparative statement is as follows:

COMPARATIVE STATEMENT—RAY CONSOLIDATED COPPER CO.

	1917	1916	1915
Operating revenue	$21,278,070.90	$20,060,783.48	$10,498,961.82
Operating expense	11,299,415.22	8,200,633.42	6,125,590.43
Net income	$9,978,655.68	$11,860,150.06	$4,373,371.39
Other income	437,647.14	224,015.71	376,691.49
Total income	$10,416,302.82	$12,084,165.77	$4,750,062.88
Other charges	715,133.08	367,737.76	462,857.04
Net profit	$9,701,169.74	$11,716,428.01	$4,287,205.84
Dividends	(a)6,624,151.80	4,337,954.75	1,872,319.07
Surplus for year	$3,077,017.94	$7,378,473.26	$2,414,886.77
Balance Dec. 31	$16,890,195.62	$13,813,177.68	$6,434,704.42

(a) Includes $788,589.50 capital distribution.

Chino Copper Co.

The report of the Chino Copper Co. for the year ended Dec. 31, 1917, shows net profits of $9,512,854, a decrease of $3,015,094, as compared with the previous year. The net profits for 1917 were equal to $10.93 a share on 869,980 shares of stock ($5 par), as against $14.40 a share earned in the preceding year.

COMPARATIVE STATEMENT OF CHINO COPPER CO.

	1917	1916	1915
Operating revenue	$19,261,305.89	$19,219,767.21	$11,383,777.48
Operating expense	9,434,689.81	6,701,891.03	4,695,048.41
Net income	$ 9,826,616.08	$12,517,876.18	$ 6,688,729.07
Other income	310,435.89	325,285.55	229,073.63
Total income	$10,137,051.97	$12,843,161.73	$ 6,917,802.70
Other charges	624,197.69	315,203.51	261,084.69
Net profit	$ 9,512,854.28	$12,527,948.22	$ 6,656,718.61
Dividends (a)	(a) 8,612,802.00	7,177,335.00	2,609,860.00
Surplus for year	$ 900,052.28	$ 5,350,613.22	$ 4,046,858.61
Balance, Dec. 31	$14,863,926.08	$13,963,873.80	$ 8,613,260.58

(a) Includes $1,087,475 capital distribution.

Gross production of copper for the year was 83,339,782

lb. After making smelter deductions, net production was 79,636,235 lb. There was also produced gold and silver valued at $567,160.28. Net cost of producing copper for the year was 11.30c. per lb., as compared with 8.7c. for 1916.

Ore and waste removed by steam shovels during the year amounted to 5,583,016 cu.yd., of which 3,712,414 cu.yd. was stripping and the remainder represents 3,607,825 tons of ore. Average steam-shovel costs during the year were 50.88c. per cu.yd., for the removal of both ore and stripping, as compared with 37.97c. per cu.yd. in 1916 and 35.28c. per yd. for 1915. The advance in costs is attributed to increases in wages, shortening of hours and increased cost of materials. Two additional sections were added to the five-section mill at Hurley, and several alterations were made. The completion of these improvements, as well as putting into service the second unit of the primary crushing plant at Santa Rita, resulted in the treating of additional tonnages. During 1917, a total of 3,608,100 tons of ore was treated at the mill.

Annual Report of Shattuck-Arizona Copper Co.

In 1917, the Shattuck-Arizona Copper Co. produced 11,935,317 lb. of copper (91.4 lb. per dry ton); 2,010,-145 lb. lead (310.86 lb. per dry ton); 154,344 oz. silver and 1542 oz. gold. Dry tons of copper ore mined were 130,645; of special ores 6804, approximately the same tonnages being shipped. Copper ore smelted was 130,-583 and special ores 7992 dry tons. The gross operating cost was $12.14 per dry ton, or 15.638c. per lb. fine copper; net operating cost was $10.01 per dry ton; or 13.242c. per lb. fine copper. Sales contracts for 1917 delivery called for 15,658,793 lb. fine copper, but, due to curtailment of production caused by a strike in June, refinery deliveries fell short of this amount by 883,-402 lb. The average gross price received per lb. refined copper delivered was 28.317c. Entire production brought an average gross price of 28.123c. per lb.

During the first five months of 1917, the mine output kept up with the record set in 1916. Labor unrest resulting in the strike of June 26 caused a cessation of production during July. Efforts to increase mine output were made, but the small amount of development work performed and lower average grade of ore mined hindered progress. Copper ore reserves were depleted during the last seven months of the year. The cost of copper per lb. increased because of lessened labor efficiency, lower grade of ores and greater supply costs.

Shipments of high-grade lead ores were made at a rate of 150 tons per week. Amount of low-grade siliceous lead-silver ores blocked out was increased. Mill tests on these ores were conducted in February and March, 1917, at the Copper Queen experimental mill, and showed that 92% of the lead and 80% of the silver could be recovered at a profit of at least $4 per ton of ore treated under normal prices of the metals. Construction of a 400-ton lead mill was begun during the year, mill site and water being obtained from Denn Arizona Copper Co. Estimated cost of the new mill is $240,000. During the year $54,815 was spent on new construction and the total expenditure for mill construction and equipment was $41,824.

The total development work for the year 1917 of 310 working days was 15,793 ft., bringing the total to date to 127,855 ft. The sum of $35,920 was charged to operations during the year for replacement of air drills, mine cars and other mine equipment.

Sales of copper, gold, silver and lead realized $3,609,-989.31, interest and miscellaneous receipts bringing the gross income to $3,652,155.55. Total expenditures were $2,174,655.64, consisting of $1,888,104.03 for mining, development, refining and marketing of ores, and $286,-551.61 for general administrative expenses, including taxes. The net income was thus $1,477,500.21. After setting aside $33,096.41 for depreciation of plants and equipment and $730,762.98 for depletion of mine, the net profit was $713,640.82. A surplus of $101,140.82 remained after payment of four quarterly dividends totaling $612,500. Stockholders received $1,050,000 in four payments during the year as capital distribution. A fifth payment of $87,500 as capital distributed was due on Jan. 19, 1918.

Calumet & Arizona Mining Co.

During the year ended Dec. 31, 1917, 59,353,140 lb. of copper were produced from the mines of the Calumet & Arizona Mining Co. The smeltery production amounted to 96,081,007 lb., part of which was custom ore. Development work in 1917 was 98,161 lin.ft. During the year, 50,572 tons of high sulphur, low-grade copper ore, 3259 tons of manganese ore, 1607 tons of lead-zinc sulphides and 1458 tons of lead ore were shipped to outside points. A total of 784,506 tons of wet and 747,456 tons of dry ore were mined.

Below is a comparative statement covering the years 1915, 1916 and 1917:

COMPARATIVE STATEMENT CALUMET & ARIZONA MINING CO.

	1917	1916	1915
Gross income	$20,035,866.01	$20,587,940.60	$11,683,724.13
Operating expense	8,094,223.93	7,674,250.61	4,947,675.46
General expense	44,191.33	80,723.79	35,557.11
Freight, etc	1,219,797.98	1,337,073.73	883,422.36
Taxes	2,157,946.82	339,057.09	358,940.25
Balance	$8,519,705.95	$11,156,835.38	$5,458,128.95
Depreciation	115,000.00	.....	.....
Depletion	1,773,945.36	.....	.....
Miscellaneous expense	2,259.73	1,830.57	4,247.44
Net income	$6,628,500.86	$11,155,004.81	$5,453,881.51
Dividends	7,067,241.00	5,777,296.00	2,006,557.00
Deficit	$438,740.14	(a)$5,377,707.81	(a) $3,447,324.51

(a) Surplus.

New Cornelia Copper Co.

The year 1917 marked the beginning of the New Cornelia Copper Co. as a substantial copper producer. Total income for 1917 was $3,810,122.83; operating and general expenses, freight and taxes amounted to $2,136,483.23, leaving a balance of $1,673,639.60. Deducting depreciation, depletion, exploration and interest charges of $911,288.83, a net income of $762,410.77 remains. Copper production for the year was 19,482,191 pounds.

South African Diamond Output in 1917, according to a Reuter dispatch from Johannesburg, totaled 2,902,416 carats, valued at £7,713,018. Sales amounted to 2,416,208 carats, valued at £6,170,900. The production increased by 556,086 carats and the sales by 124,253 carats, as compared with 1916.

Events and Economics of the War

The complete check given the Germans before Ypres has been followed by another pause in the great offensive, during which the Allies have made minor advances around Kemmel and in the Amiens sector, thereby strengthening their positions; an attack on the Americans near Villers Bretonneux was repelled; General Foch assumed the Italian command. Cancellation of all "most-favored-nation" trade agreements one year hence and a substitution therefor of a bargaining tariff was announced by the French ministry (on Apr. 25). Sebastopol was occupied by the Germans and Kiev placed under military rule; the Prussian lower house voted down suffrage reform; defeat of the Bolsheviki and capture of Viborg by Finnish "White Guards" was reported. In England, action on Irish conscription was postponed. The advance of the British on Mosul, in Mesopotamia, has reached the Tauk River.

In this country, the Liberty loan campaign ended on May 4, a large oversubscription and a record number of subscribers having been secured. Plans for increasing the Army were laid before the House Committee on Military Affairs by Secretary Baker. The Senate decided to inquire into air-craft production. The Sedition bill was sent to the President for signing.

Steel Men Pledge Output to War Needs

"We do not like the expression of 'doing your bit'; we want you to do your all," J. Leonard Replogle, director of steel supply of the War Industries Board, told the conference of iron and steel men in the offices of the United States Steel Corporation on Apr. 26. "The Government will not tolerate any more the procedure of some steel companies. . . . There is too great a percentage of non-war material being produced," said Mr. Replogle. "Contrary to the general impression that there is a surplus of steel, there is a very decided and acute shortage, which is delaying the war program."

The building construction planned by the Government is about 20% greater right now than the total building construction of the United States for the three-year period, 1915, 1916 and 1917, Mr. Replogle stated. An enormous percentage of the steel plates required is needed directly not only for our own operations but for our Allies. Much projectile steel is being rolled in rail mills, and the rail situation is becoming acute. On structural shapes, direct Government requirements alone will take 14 weeks' work; on tin plate there is 23 weeks, wire pipes and tubes 28 weeks, wire and wire products 19 weeks and on the all-steel product report there is 31 weeks' operation at an average of 640,000 tons a week —a little over 30,000,000 tons annually.

"We run against the proposition," Mr. Replogle told the manufacturers, "that you are short of steel for this and that, and you are short of fuel and cannot operate, but somehow that shortage seems to fall on Government necessities."

Judge Gary, chairman of the conference, finally proposed a pledge binding all the companies represented at the meeting to shelve all commercial orders and devote full capacity to business for the United States and the Allied governments. The pledge was accepted unanimously by a rollcall of the 45 concerns which had executive officers there.

Gold Stock Threatened

The stock of gold accumulated in the United States since the war began will be exhausted within the next few years unless exports of commodities to South America and to neutral countries in general are increased. The National Foreign Trade Council, in its report, says that this latter must be done to conserve our resources; our foreign-trade credit balance is already enormous, and it will be years before our European Allies can pay their debts to us. Our exports of gold are steadily exceeding the imports of that metal. In March, according to the Bureau of Foreign and Domestic Commerce, the imports were less than $2,000,000 and amounted to only $83,000,000 during the nine-month period ended with March, against $801,000,000 for the corresponding period last year. Exports of gold, on the other hand, were $181,000,000 in the nine months ended Mar. 31, against $150,000,000 in the corresponding period in 1917. Exports of the metal for March were less than $3,000,000.

The excess of exports over imports for the nine-month period ended Mar. 31 was thus $98,000,000, the largest surplus of gold exports on record for that period. Even during the nine months from July 1, 1914, to Mar. 31, 1915, which was the period of the war panic, gold exports were only $69,400,000 ahead of imports. The recent large surplus occurred almost wholly in July, August and September of 1917, in which quarter the export surplus was $96,200,000. The continuation of this drain on the country's gold stock will weaken the basis for large credit operations in Europe.

"So long as the war continues," says the report of the National Foreign Trade Council, "shipments to European Allies and Canada must be at least maintained at present volume, and no increased imports of merchandise from Europe can be expected in payment. Such gold shipments as can be made will be a drop in the bucket (the United States having already more than one-third of the visible gold supply of the world), and American securities which can be sent back from Europe to the United States are daily becoming scarcer. The United States must, from necessity, export yearly on credit, pure and simple, merchandise to the value of at least $4,000,000,000, and this represents nearly two-thirds of our total exports."

Total imports into the United States in 1917 (of all commodities) from the Allies, including Canada, British and French Oceania and British Africa, were

$936,208,000, and exports from the United States to those countries in the same calendar year were $4,680,394,000. Exports of the United States to South and Central America, Mexico, Panama, West Indies, Philippines, non-British Africa and Asia, during 1917, were $1,184,926,000, and imports from this second group were $1,894,118,000. The United States must continue to look to the second group of countries as the only possible sources of supply for certain raw products absolutely needed for manufacture of material which must be sent to Canada and Europe, and food products must be imported on an enormous scale to take the place of those sent out of the country.

Would Add Secretary of Foreign Trade to Cabinet

The part of the metal trades in carrying on the war was discussed by E. A. S. Clarke, president of the Lackawanna Steel Co., at the recent National Foreign Trade Convention in Cincinnati. In concluding, a plan along which manufacturers might organize for after-war trade was outlined by Mr. Clarke, who said:

The assistance furnished to our Government in the working out of the many problems involved in meeting war requirements, by the coöperating committees of the American Iron and Steel Institute, suggests a method by which, under the Webb act, committees or associations might assist in devising plans for meeting world competition after the war, for resisting the foreign invasion of our own markets and for promoting the distribution and sale throughout the world of our own products. At present the work of the American Iron and Steel Institute in connection with war requirements is performed by a number of subcommittees subject to one general committee.

In other lines of industry, similar committees, each composed of members fully conversant with its particular subject or department, reporting to a general committee on foreign trade, of the respective industries, might deal effectively and successfully with our export problems. To subcommittees might be assigned the duty of covering certain important phases of foreign commerce, such as credits, transportation and freight rates, port facilities, customs tariffs, etc.

In view of what is being done along similar lines by the governments of the manufacturing nations of Europe, it would seem that our Government might well consider establishing a separate administrative department, with a member of the Cabinet at its head (in effect, a Secretary for Foreign Trade), whose duty it would be to foster and assist in mobilizing the development and extension of the foreign trade of the United States, and to which the committees above suggested could make recommendations, and under whose direction and supervision they might, if approved, be carried out.

Shipworkers Break Riveting Records

"Finner" Schock promises to be one of the Ty Cobbs in the new national riveting game, says the *Emergency Fleet News*, published by the Emergency Fleet Corporation. "Finner" is the crack riveter at the Baltimore Drydocks and Shipbuilding Co. On Apr. 9, with his gang, he drove 2720 three-quarter-inch snap rivets in the floor of an 8800-ton steamer in nine hours. Schock's speed was too much for an ordinary gang, and he had to put on an extra heater boy and an extra passer boy. The record was made in nine hours, even breaking the one made the week before by John Fraser at the American Shipbuilding Co.'s plant at Buffalo, N. Y. Fraser drove 1624 seven-eighths-inch countersunk rivets in 8 hours and 43 minutes.

Other high records were those made by John Stark, at the American company, who drove 2089 flush seven-eighth-inch rivets in 8½ hours, actual time; by Beckle, at the Downey plant at Milliken, N. Y., who drove 1512 seven-eighth-inch rivets in 8¾ hours.

Schock's record was later beaten by Mulham, at the Fore River yard of the American Shipbuilding Corporation, who drove 2805 three-quarter-inch oil-tight rivets in 9 hours. A day or so later, Edward Gibson, of the Federal company's plant in New Jersey, walked off with the title by pounding home 2919 rivets.

Great progress has already been made in working out a standard scoring method for steel rivets. This problem presented manifest difficulties by reason of the great variety of riveting work on the average steel merchant ship, but a technical committee in the Steel Ship Construction Division, Emergency Fleet Corporation, has gone into all phases of the problem and, moreover, has already arrived at a definite practice.

Locomotives Ordered by Government

Contracts for 1025 freight and passenger locomotives, the largest single order ever placed in the history of American railways, have been let by the Railroad Administration to the American Locomotive Co. and the Baldwin Locomotive Works. The entire order represents a cost of about $60,000,000, or an average price of a little less than $60,000 for each locomotive. The profit to manufacturers, who will divide the work about equally, will be between 5 and 6%, less than half the rate of profit represented in the original bids.

Six newly developed standard types of engines, including the Mallet, with heavy and light sizes of each type, were ordered. Deliveries will begin in July and continue through the year, and most of the new engines, it is understood, will be assigned to Eastern roads, where the shortage of motive power is greatest. They will bear only the initials "U. S." and identifying numbers, and will be virtually the first lot of engines to be owned jointly by all railroads under Government management. About 200,000 tons of steel will be required, and the War Industries Board has allotted the full quota of steel to the Railroad Administration.

War Finance Corporation Directors Appointed

President Wilson appointed four directors of the new $500,000,000 War Finance Corporation on Apr. 29, and a new Capital Issues Committee provided for in the War Finance Corporation act. Directors of the corporation, as appointed, were William P. G. Harding, of Alabama; Allen B. Forbes, of New York; Eugene Meyer, Jr., of New York; and Angus W. McLean, of North Carolina. Mr. Forbes, however, declined the appointment.

Members of the Capital Issues Committee are Charles S. Hamlin, of Massachusetts; John Skelton Williams, of Virginia; Frederic A. Delano, of Illinois; James B. Brown, of Kentucky; John S. Drum, of California; Henry C. Flower, of Missouri, and Frederick H. Goff, of Ohio.

"The President's appointments," says the *Evening Post*, "indicate that the chief responsibility for the important work involved will in reality rest on the Federal Reserve Board. That board has one representative on the Finance Committee's directorate and two on the committee to regulate new security issues, and on each it holds the chairmanship. On the whole, this lodges authority where it should be lodged; for the task of each organization involves problems of such peculiar delicacy as to make it highly important that well-known men, already in posts of great public responsibility, should have a directing hand. Aside from Mr. Harding, Mr. Hamlin, and Mr. Delano, the two boards include a few well-known names, though the larger number are not familiar to the general public. Selection of the Capital Issues Committee was evidently governed, as was indeed essential, by the desire to have the different sections of the country represented on it."

Large Interests Held by Germans In South Africa

The report of the South African Custodian of Enemy Property, which has recently been issued, contains much interesting information regarding German peaceful penetration in the Union, according to London advices. It shows that no less than 26,000 enemy shareholders in gold, coal and other mining concerns in the Union own holdings to the aggregate nominal value of nearly $37,500,000.

The custodian has completed the most essential part of his work. Eighteen enemy firms, or firms having large enemy or enemy subject interests, have been ordered to be wound up, and others have gone into voluntary liquidation; and there is no firm in the Union now carrying on business wholly or chiefly in the interests of enemy persons as the term is defined for the purposes of the British Trading with the Enemy Act. In addition, the custodian has taken charge of enemy shares in mining companies to the face value of $24,000,000.

Naval Bill Forbids Introduction of Efficiency Methods

In passing the Naval Appropriation bill, the House reënacted the anti-efficiency section demanded by organized labor. It was thought that its defeat might have led to a serious labor disturbance, though it is admitted that maximum production could not be attained with the section in operation. The section has been effective on War and Navy Department contracts since 1915, prior to which the Taylor efficiency system was employed in nearly all Government arsenals. Under the latter system, the output of the average efficient workman in an eight-hour day was determined by time study; this output was then fixed as the minimum demanded from all workmen in return for the flat daily wage. Production over this minimum was paid for by proportionate bonuses. The introduction of such methods, where not already existing, is expressly forbidden by the anti-efficiency provision of the Naval bill.

Retention of the section by Congress is forecast by *Iron Age*, which says that employers and employed alike are expected not to demand other than pre-war labor conditions. "Government shops without scientific management before the war cannot now, without the unlikely consent of the workers, introduce the expressly prohibited phases of such management." Omission of the section from the bill would doubtless be looked upon by labor as amending existing legislation.

Bureau of Mines Needs Technical Men

Van. H. Manning, director of the U. S. Bureau of Mines, has made the following announcement:

Important chemical and other technical engineering work, necessary for the prosecution of the war, is being carried on by the U. S. Bureau of Mines experiment station, at Washington, D. C. The services of trained men of the following classifications are urgently needed: Bacteriologists, biologists, chemists (inorganic, organic, physical and electrochemists), chemical engineers, draftsmen, electrical engineers, instrument makers, laboratory assistants, laborers, machinists, physiologists, plumbers, steamfitters, stenographers and skilled labor of various kinds.

If your training fits you for any of these occupations, send to the U. S. Bureau of Mines, American University Experiment Station, Washington, D. C., for blank forms. When properly executed and returned by you, these forms will be placed on file, and when a vacancy occurs you will be considered for it and will be notified if your services are desired.

If you are a registrant in the draft, and have not yet been ordered to camp, it may be possible to have you immediately inducted into the service for work here. If you are *not* in the draft, but feel that you wish to serve your country in the present crisis, you can enlist, or serve as a civilian. Serve your country where you can serve it best.

War Taxes Spent as Fast as Received

Income and excess profits taxes are now expected to bring about $3,000,000,000 into the Treasury in June, or $500,000,000 more than estimated before returns were filed. Nearly every dollar will be spent by the time it is collected to meet the $1,000,000,000 monthly excess of Government expenses over ordinary receipts and to redeem the $2,000,000,000 of certificates of indebtedness falling due in June—$1,500,000,000 of tax certificates and $500,000,000 of loan certificates. Government expenditures have increased recently to a monthly outlay of more than $1,200,000,000, of which $900,000,000 is for direct Government or war purposes and $300,000,000 for loans to the Allies. Receipts from customs and ordinary internal revenue sources amount to about $200,000,000 a month, leaving a current deficiency of $1,000,000,000. Most of this must be covered ultimately by Liberty Bonds. War expenditure of the United States in April was at an average of $40,000,000 a day.

Ship Cost a Factor in Post War Trade

A large part of the cost of the new ships in the merchant fleet that the Government is building should be charged to the war, in the opinion of Robert H. Patchin, of W. R. Grace & Co., if they are to be operated at a profit after the war. They are costing from $150 to $175 per ton, and are cheap at this price if they help beat Germany, but when they enter peaceful trade after the war, they must meet the competition of ships built by other countries before the war at a cost as low, in some cases, as $50 per ton.

Remember the Comfort Fund of the 27th Engineers.

Industrial News from Washington

By Paul Wooton, Special Correspondent

Mineral-Control Bill Considered By Senate Committee

That it is the intention of the Government to commandeer the entire sulphur output of the country, and that the War Industries Board is greatly in fear of a runaway market in domestic ores as a result of the curtailment of imports, were two outstanding points developed at the interesting hearings on the Minerals-Administration bill in progress before the Senate Committee on Mines and Mining. These are being conducted by Senator Henderson, of Nevada, the new chairman of the committee. He regards the bill as of such great importance as to require extended hearings, and all interests that may be affected by the bill have been given an opportunity to be heard.

Philip N. Moore brought out the information with regard to the commandeering of sulphur, to insure an adequate supply for munitions work. The sulphur obtained from coal brasses is not suitable for munitions and is to be utilized in the making of fertilizer.

C. K. Leith, chairman of the U. S. Shipping Board's Committee on Mineral Imports and Exports, urged the passage of a bill which would centralize authority in mineral matters. He cited examples showing that the work is now in many hands, in separate divisions of the Government departments. As a result, representatives of the industry affected are confused.

Owing to the uncertainty of the future, Professor Leith counselled against any effort to embody in the bill the prices which should be guaranteed. He is of the opinion that the proper way in which to handle such a matter is to delegate the power to an official who could exercise it when necessary or desirable. He also expressed the opinion that there are too many difficulties in the way to permit of setting a proper maximum price on minerals covered by the bill.

Professor Leith also pointed out that the ship controller is finding it impossible to maintain the schedule of mineral imports which the committee has recommended. As an example, he stated that last month the imports of manganese were only 15,000 tons, despite the fact that the committee had set 35,000 tons as the amount of manganese ore which should have been imported. He commended the steel manufacturers for the earnest efforts they are making to utilize domestic manganese and chrome to replace the imported product, and introduced into the record a letter from James A. Farrell, the president of the United States Steel Corporation, showing that the specifications for ferromanganese have been reduced from 80 to 70% and that steps have been taken to make a larger substitution of spiegeleisen in making higher-carbon steels. The standard has been lowered from 20 to 16% manganese. Professor Leith also expressed the opinion that authority must be lodged with the Government to make possible the allocation of supplies and other functions which could not be undertaken by the consumers themselves.

Mr. Moore, in his testimony, declared that nothing short of Government control can cope with the present mineral situation. He favors a more extended bill than the one now before the committee. He conceives it to be the duty of the Government to adjust matters when the usual results of supply and demand do not take place. He called particular attention to the excessive spread at times between the price of manganese ore and the alloy.

Horace H. Lamson, of John S. Lamson & Bro., of New York, importers of high-grade manganese ore, told the committee of conditions surrounding the chemical-ore industry. He described the prices being paid for much high-grade manganese ore as "fabulous," and expressed the opinion that such prices would stimulate production if anything would. Mr. Lamson estimated the annual needs of the country for chemical ore at between 50,000 and 60,000 tons and professed little faith in the ability of domestic producers to furnish any great amount of the needed supplies, regardless of the aid which would be extended them by the bill. He declared himself, however, as in favor of the bill, but recited the difficulties he had encountered in an effort to secure a uniform high-grade ore from domestic sources. Imports of high-grade ore should be permitted, he urged, until it is demonstrated that the country can furnish its own supplies.

Mexico Revises Metal Export Taxes

Export taxes on metals shipped out of Mexico have been revised, and on shipments made after Apr. 1 are as follows: Gold, $21.47½ per lb.; silver in bars or ingots, 63¾c. per lb.; silver in ore or concentrates, 89½c. per lb.; copper in bars or ingots, 1.19c. per lb.; copper in ore concentrates, 1.42c. per lb.; lead in bars or ingots, .00155c. per lb.; lead in ore or concentrates, .002139c. per lb.; zinc in bars or ingots, .005589c. per lb.; zinc in ore or concentrates, .007454c. per lb.; tin in bars or ingots, 2.585c. per lb.; tin in ore or concentrates, 2.703c. per lb.; antimony in bars or ingots, .001343c. per lb.; tungsten in ore or concentrates, 4.33c. per lb.; manganese, .001863c. per lb.; mercury, 4.784c. per lb. The figures are in United States currency.

Chilean Nitrate Arriving Slowly

Shortage of ships has made it impossible for the Department of Agriculture to import nitrate from Chile at anything like the rate originally contemplated. Had it been possible for the U. S. Shipping Board to assign ships as promised, 100,000 tons of the department's purchase would now be in this country. Instead, only 21,000 tons has been received.

Radium has been placed on the export conservation list by the War Trade Board.

Up Came McGinty from the Bottom of the Sea

"Bully," says Bill McGinty as he bobs up from Davy Jones' locker, just long enough to send us a check for the Comfort Fund. "I'm engaged in prospecting down on the Spanish Main, and I can't help chipping in for the regiment. When it comes to spotting a good proposition, I'm a regular shark, and I recommend the Comfort Fund to all."

Our friend has rather an odd way of expressing himself, but it is deeds and not words that count most. He sets an example that others may well follow, and the message underlying his words is that the man who has not the interest of our mining regiment at heart simply doesn't belong. The fund now stands above the $13,000 mark. It's moving, but it has a long way to go.

We feel a keen appreciation of some generous contributions that have been made to the Comfort Fund by some of our British, Canadian, and Australian friends. There is a graciousness in their interest in an American mining regiment that warms us to them. The list of contributors to the fund to date is as follows:

Engineering and Mining Journal	$1000.00
New York Engineering Co.	1000.00
A Friend, Nov. 23	5.00
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D. E. Charlton	5.00
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William Young Westervelt	50.00
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Oscar Lachmund (second contribution)	10.00
L. R. Budrow	10.00
Horace V. Winchell	50.00
W. J. Pentland	10.00
Dome Mines Co.	50.00
Butte Copper and Zinc Co.	100.00
Eagle & Blue Bell Mining Co.	100.00
William A. Nicholls	10.00
Robert S. Lewis	10.00
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East Butte Copper Mining Co.	50.00
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Fred Hellmann	50.00
B. Elkan	50.00
Judd Stewart	10.00
R. M. Raymond	50.00
J. Allen McKay	10.00
C. E. Hart (second contribution)	5.00
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Thomas H. Garnett	5.00
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Oscar Lachmund (third contribution)	10.00
Charles McKinnis	20.00
C. P. Carlson	10.00
Harry E. Hall	5.00
James Douglas	250.00
W. D. Thornton	100.00
Greene Cananea Copper Co.	250.00
Inspiration Consolidated Copper Co.	500.00
H. G. Moulton	10.00
C. A. H. de Saulles	10.00
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A. R. Ledoux	100.00
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W. B. Harper	20.00
B. R. Bates	5.00
William S. Robinson	50.00
C. A. Fay	10.00
"Bill McGinty"	10.00
H. S. Salmon	5.00
O. M. Bilharz	25.00
C. F. Kelley	50.00
Total	$13,354.00

Make your checks payable to W. R. Ingalls, treasurer of the Association of the 27th Engineers. Because of the work involved in administering the Comfort Fund, contributions are acknowledged only by publication in the *Journal*.

Engineering Council Considers Industrial Efficiency

The Engineering Council appointed the following special committee on industrial affairs at its meeting on Apr. 18: Prof. George F. Swain, of the Massachusetts Institute of Technology and chairman of the Boston Transit Commission, chairman; E. W. Rice, Jr., president of the General Electric Co.; Charles T. Main, president of the American Society of Mechanical Engineers; Alexander C. Humphreys, president of the Stevens Institute of Technology and of the Buffalo Gas Co., and B. B. Thayer, vice president of the Anaconda Copper Mining Co. Owing to the rapidity with which the Army and Navy appropriation bills were being considered by Congress, and the fact that these bills contained proposals opposed to well-tried industrial methods for improving efficiency and increasing production in manufacturing plants, the committee without delay drafted a resolution, which was adopted on Apr. 22 by special action of the Engineering Council. This resolution is as follows:

Whereas, The winning of the war imperatively demands highest efficiency and maximum production in every branch of industry; and,

Whereas, We are informed that Congress has under consideration, in the Navy and Army appropriation bills, proposals to prohibit, diminish and condemn the payment to public employees, or to employees of private establishments under Government control, any cash reward, premium or bonus for superior service, and,

Whereas, These methods, if applied with due regard to wages, surroundings, health and safety of the employee, will increase efficiency and production and help win the war and preserve our institutions; be it therefore

Resolved, That in the opinion of Engineering Council, representing the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, together having 33,000 members, it is vital to the winning of the war that no legislation nor other measure should be adopted which may interfere with highest efficiency and maximum production, but that, on the contrary, every proper means should be taken to increase efficiency and production.

This resolution was telegraphed to the Senate Committee on Naval Affairs and to Charles M. Schwab, manager of the Emergency Fleet Corporation. It has also been sent to the Senate Committee on Military Affairs and to a number of engineers in the home states of the Senators on these two committees, with a request to these engineers that they communicate at once with their Senators.

The objectionable clause in the appropriation bills is as follows:

That no part of the appropriations made in this act shall be available for the salary or pay of any officer, manager, superintendent, foreman, or other person having charge of the work of any employee of the United States Government while making or causing to be made with a stopwatch or other time-measuring device a time study of any job of any employee between the starting and completion thereof, or of the movements of any such employee while engaged upon such work; nor shall any part of the appropriations made in this act be available to pay any premiums or bonus or cash reward to any employee in addition to his regular wages, except for suggestions resulting in improvements or economy in the operation of any Government plant.

Engineers, especially those engaged in industrial operations, would readily appreciate the serious effect which legislation of this character, if passed, would have upon private plants engaged largely or exclusively upon war work under the appropriations carried in these bills. It is most important that such measures should not be enacted.

A careful reading of the third preamble of the resolution adopted by the Engineering Council will show that the council and its committee fully realize that the best interests of the workmen must be conserved, and its action has no ulterior purpose to the contrary. The earnest desire of the Engineering Council is patriotically to promote in every way the largest production and best efficiency of the country's industrial establishments.

Upon the subject matter of the resolution presented on Apr. 18 by F. P. Fish, chairman of the National Industrial Conference Board, the special committee is now concentrating its attention and making a careful investigation. The resolution is as follows:

Whereas, It is daily becoming more apparent that the winning of the war demands the highest efficiency in every kind of production; and,

Whereas, Many causes and circumstances have unfortunately operated to obstruct, diminish and even interrupt necessary war production, and there is much information and experience to justify the belief not only that we are in many instances securing less production per unit of time and person than heretofore, but that the country is continuously confronted with proposals to lessen the hours of production without first determining the wisdom of such action; and,

Whereas, It seems that manufacturers are not fully alive to the necessity of not only providing the best and most systematic service instruction to new labor, but should constantly be endeavoring, by every practical means, to improve the efficiency of the older force, the plant and themselves; and,

Whereas, It appears that Congress has under consideration, in the Navy and Army appropriation bills, proposals to prohibit, diminish and condemn the payments to public employees or to employees of private establishments under Government control any cash reward, premium, or bonus for superior service and to forbid time studies; and,

Whereas, It appears that the members of the great engineering societies of the United States are peculiarly qualified, by virtue of their knowledge and experience, to express an opinion upon the present efficiency of our production, and upon the most practical means of increasing the productive capacity of both management and men, and to call to public attention questionable proposals threatening our efficiency as a nation, and therefore our capacity to perform our full duty in this great struggle; therefore be it,

Resolved, That the National Industrial Conference Board respectfully requests that the engineering societies of the United States investigate and publicly express themselves as to whether or not we are losing or gaining in industrial efficiency, and to state what causes, if any, in their opinion, are influencing the condition, and in what manner, broadly, they believe our industrial efficiency can be further stimulated.

Copper Refineries May Be Placed On Preferred List

WASHINGTON CORRESPONDENCE

Every effort is being made by Pope Yeatman to have copper refineries placed on the next preferential list which will be issued by the War Industries Board. Indications are that he will be successful. Evidence has been submitted showing how essential it is for these refineries to be assured adequate fuel.

Two billion feet of lumber were used for purposes of national defence during the last eight months, according to R. S. Kellogg, secretary of the National Lumber Manufacturers' Association. The total lumber production of the United States in 1917 was twenty times as great, or about 40 billion feet.

Metal and Ore Imports and Exports in March

Imports of zinc ore showed a marked decrease in March of this year, as compared with March, 1917, according to the returns to the Department of Commerce. On the other hand, lead imports increased decidedly. The scarcity of ships is reflected in the imports of manganese and graphite, although a slight increase is shown in the tonnage of pyrites coming into this country.

Exact figures showing quantity of some of the metal imports and exports follow:

IMPORTS

	March, 1917	March, 1918
Zinc ore and calamine, contents, lb.	20,936,418	4,801,336
Lead ore, contents, lb.	5,326,395	6,903,016
Lead bullion, contents, lb.	6,870,205	14,340,440
Lead pigs and bars, lb.	116,269	1,061,004
Copper ore, contents, lb.	7,684,188	11,068,341
Copper concentrates, contents, lb.	3,047,861	3,724,800
Copper matte, regulus, etc., contents, lb.	218,957	3,599,160
Unrefined block, blister and converter copper in bars, lb.	31,799,828	36,514,548
Manganese, oxide and ore, long tons	56,394	19,300
Iron pyrites, long tons	49,682	51,276
Graphite, long tons	3,268	337
Antimony ore, contents, lb.	914,783	234,356
Matte, regulus or metal, lb.	123,200	3,048,752

EXPORTS

	March, 1917 Lb.	March, 1918 Lb.
Spelter in pigs, plates, slabs, etc.:		
From domestic ores	32,995,927	12,875,541
From foreign ores	16,460,535	4,072,900
Lead in pigs, bars, etc.:		
From domestic ores	7,488,872	16,363,220
From foreign ores	1,671,469	1,998,566
Copper:		
Ore, contents	331,035	270,175
Concentrates, matte or regulus, contents	130,096	111,320
Refined in ingots, bars, etc.	102,814,125	61,902,754
Sulphuric acid	5,047,814	8,209,373

Exports of refined copper to the United Kingdom in March, 1917, were 33,981,991 lb., and in March, 1918, they were 9,830,999 lb. Exports to France increased from 35,402,314 lb. in March, 1917, to 41,106,448 lb. in March, 1918.

How One Mining Company Secured Action on Liberty Loan Subscriptions

A campaign for the Third Liberty Loan among employees of the United Verde Copper Co. and its subsidiaries—the United Verde & Pacific Railway Co., the Verde Tunnel and Smelter R.R. Co., and the Clarkdale

SUBSCRIPTIONS TO THIRD LIBERTY LOAN BY EMPLOYEES OF THE UNITED VERDE COPPER CO.

	United Verde Copper Co.	United Verde and Pacific Ry. Co.	Verde Tunnel and Smelter R.R. Co.	Clarkdale Improvement Co.	Total all Companies
Number of subscriptions	1,975	91	53	25	2,144
Number of employees	1,975	91	53	25	2,144
Per cent. of subscribers	100%	100%	100%	100%	100%
Amount subscribed	$149,000	$6,350	$5,150	$2,150	$162,650
Average per man	$75.44	$69.78	$97.17	$86.00	$75.86

Improvement Co.—resulted in subscriptions from 2144 employees, registering 100% signers, and totalled $162,650. The company assisted employees in their subscriptions by agreeing to buy the bonds for which they subscribed and will permit them to pay for same in five or ten monthly payments, in exceptional cases even allowing a longer period. The result as shown by the accompanying table was attained by organizing the entire mine and plant into units, with a committee of workmen in each unit to attend to the soliciting of subscriptions. Where different nationalities were represented, men of each nationality were appointed to assist in the work among men of their own race. Also, each craft had its representatives in this work, and a great deal of friendly rivalry developed among the different departments and units. In the mine, each foreman worked for a record, and got a perfect one.

The following figures, taken from the last nationality statement of the company, show the diversity in the class of subscribers: American, 392; Canadian, 18; English, 18; Irish, 53; Scotch, 5; Welsh, 4; Mexican, 401; Spanish, 68; Portuguese, 5; French, 3; Italian, 57; Dutch, 1; Scandinavian, 21; Russian, 21; Finnish, 8; Serb, 32; Greek, 3; Slav, 96; German, 1; Austrian, 60; Bulgarian, 7; Miscellaneous, 6.

Chronology of Mining for Month of April, 1918

Apr. 1—Prices on ore, coke, steel and steel products, recommended previously by the price-fixing committee of the War Industries Board, subject to revision on Apr. 1, were ordered by President Wilson on Mar. 26 to be continued in effect until July 1.

Apr. 6—Opening of third campaign for three billion dollar loan in 4¼% 10-year Liberty bonds.

Apr. 9—Conference of wire-rope manufacturers with Mark L. Requa, head of the oil division of the U. S. Fuel Administration, at which it was decided to speed up the production of the domestic wire-rope industry.

Apr. 14—Daylight-saving regulation became effective in Canada.

Apr. 14—Charles M. Schwab was appointed Director General of the Emergency Fleet Corporation.

Apr. 16—Issuance of patents and copyrights to enemies stopped, and Americans forbidden to apply for patents in enemy countries.

Apr. 17—Settlement by the President of the differences between Fuel Administrator Garfield and John Skelton Williams, director of purchases for the Railroad Administration, by ruling that all coal for the railroads will be bought by Director General McAdoo in coöperation with Fuel Administrator Garfield and Bernard M. Baruch, chairman of the War Industries Board.

Apr. 23—The Pittman silver bill, after passing the Senate and House, was signed by the President, authorizing the use of $350,000,000 in silver in the U. S. Treasury for cancellation of foreign obligations, and replacing this amount by the purchase of silver bullion at $1 per ounce.

Apr. 24—Announcement by the War Department that Nitrate Plant No. 3, composed of two units, would be built at Toledo and Elizabethtown, Ohio.

Apr. 25—Appointment of John D. Ryan, president of the Anaconda Copper Mining Co., to the directorship of aircraft production for the Army.

Apr. 26—Set aside as Liberty Day by President Wilson.

Apr. 29—The Overman bill passed the Senate.

Apr. 30—The mineral-control bill passed the House.

Editorials

The Silver Price

THE Government has been purchasing some silver for which it has paid, or will pay, $1 per oz., under the terms of the Pittman Act. However, the "official," or Handy & Harman, quotation of the silver market was only 99⅝@99¾c. contemporaneously with the Government's purchases. The difference between the quotational price and the price paid by the Government calls for an explanation.

In the first place, it should be clearly understood that the Government has not "fixed" the price for silver. The Pittman Act merely authorized the Director of the Mint to melt up the silver dollars hoarded in the Treasury and replace their bullion by new bullion to be purchased at $1 per oz., 1000 fine, the bullion to be delivered to the mints of the United States.

The Pittman Act did not go into details for execution of the business, and there is still a good deal of uncertainty as to how they will be worked out. For example, there is no mint in New York, where there are refiners that produce a great deal of silver, but there is a United States Assay Office, the most important in the country, at which bullion is taken in. Delivery at the Assay Office in New York does not conform to the literal terms of the law, which call for delivery at a mint. Inasmuch as the purchased silver is to be coined, in time at least, it is expected that the Government will insist on mint delivery.

In the second place, nobody knows as yet that the Director of the Mint will purchase all of the silver that is offered to him. The law does not require him to do so. It is assumed, however, that he will purchase all that is offered, anyway until the void in the Treasury resulting from the removal of the old bullion is filled, and it is assumed, further, that he will designate the mint to which he would like to have it delivered. Naturally, all of the silver refined in New York would be offered to the Director of the Mint for delivery in Philadelphia, but he might not be willing to purchase everything for Philadelphia delivery. Some will naturally be wanted for Denver and San Francisco delivery, and such orders will naturally be filled by refiners at San Francisco, Tacoma, Omaha, etc.

Under the most favorable circumstances, commercial silver 999 fine, to be sold in New York for delivery in Philadelphia, cannot be worth more than 99.80c. in New York, owing to the difference in the specifications as to fineness, express charges, etc. Taking into consideration the loss of interest on capital on account of the method of payment from Philadelphia, the equivalent of $1 per oz. 1000 fine at Philadelphia would probably be not more than 99.75c. per oz. 999 fine at New York.

The "official" quotation at New York is a buying quotation; i.e., the bullion brokers are presumably willing to purchase at that price. If, therefore, the quotation is 99⅝c. and they are able to sell to the Philadelphia mint, they will make ⅛c. per oz. If, however, they were obliged to ship to Denver or San Francisco, they would lose money. If it should develop that the Director of the Mint should insist on the option of ordering delivery to any mint, the New York situation would become very difficult. Pending information from the Director of the Mint as to just how he will carry out this law, there will naturally be considerable uncertainty.

The Light Breaks

FOLLOWING the days of acute anxiety that marked the titanic effort of Germany to divide and crush the Allied armies on the Western front, come three heartening events: the Teuton tide is checked—the Beast pauses to lick his wounds; the Third Liberty Loan is a most tremendous popular success; and, most significant as denoting the spirit now animating and inspiring our war industries, an unprecedented and marvelous record in shipbuilding must be recorded to the great credit of the management and men of the New York Shipbuilding Co., in the launching, at Camden, N. J., on May 5, of the 5550-ton collier "Tuckahoe," just 27 days, 2 hours and 43 minutes after the laying of the keel, on April 8. There has not been a more forceful example of efficiency, speed and enthusiasm—of team work.

The record is indeed marvelous, and merits the fine commendation extended to men and company by President Wilson and Charles M. Schwab, who informed the workmen that he had cabled the news of their achievement to General Pershing and the boys "Over There." Nor are other most hopeful signs lacking. Speed records in riveting ship-plates are being smashed every day or so; shipways are kept hot, as wooden, reinforced-concrete and steel vessels take the water; and in our shipbuilding program, the rivalry to achieve in itself assures the failure of the piratical submarine campaign that finally brought a patient and mighty nation into the conflict.

The significance of these events cannot but impress us. We as a nation are in the war. Our spirit, our will to win, and that white enthusiasm which spells sure victory, are surging up in the minds and hearts of the people of America. After the gloom produced by our delayed and inexpert attempts to get imperatively necessary tasks accomplished; after the depression springing from the failure of preliminary efforts to make the weight of our resources immediately available to our comrades in arms, hard pressed—with "backs against the wall"—the mists of uncertainty, of hesitancy, are rising and dissolving, and we are taking our place in the first line trench, and with great weight and fine effectiveness behind that line. Dissension and suspicion between capital and labor are being dissipated in the fire of patriotic devotion to an eternal principle of justice and of right. Twenty million Americans come for-

ward with the money asked for by their Government with which to "carry on." America is finding—has found—herself. It is a time of spiritual exaltation, of solemn dedication and resolution.

It is a time, too, for unbounded confidence and optimism, and for sustained and unremitting effort; for enthusiasm, team work, coöperation and such accomplishments as alone will satisfy our aims and measure our devotion to those principles on which our all is built and on which rests all our faith.

The Third Liberty Loan and the Mining Industry

THE several slogans that have sprung into being during the just-completed Liberty Loan campaign are significant of the transitional stage through which the country is passing. The idea of patriotism was emphasized; the need and value of saving were clearly brought out. To no less degree must be noted the great common bond that has been created among the people; the thought and knowledge that they are a part of the Government—shareholders in a great business—and thus is laid the foundation upon which all classes can meet on an equal basis.

Many mining companies, not to mention other industrial concerns, adopted various plans for securing subscriptions for the Third Liberty Loan, and it is with pleasure that we view the successes that have been achieved in their endeavor to promote this most patriotic service. Not only has it emphasized the fact that the mining industry is alive to the situation, that the Government must and will go on, but it shows that mine labor gives its full assent to the issue and full support to the war. Further than that, a mutual bond is created between labor and capital, for both meet on a common footing and have a common interest at heart.

The complaint of the mine laborer, that welfare work savors of paternalism, has done much to prevent the complete success of many earnest efforts put forth by some of the companies in that direction. However, the coöperation that has been secured between official and employee in this loan has, we believe, to a large extent corrected the erroneous impression that may have existed in the past, and clearly the two have been in complete accord in making the loan a success. Agreements of this sort promulgate the true development of community interest.

Drift-Gravel Mining in Eastern Siberia

IN THIS issue we present a paper dealing with drift-gravel mining in eastern Siberia by J. P. Hutchins, an experienced engineer, who has had extraordinary opportunity for observation and study of Russian mining methods and operating conditions. The present chaos in Russia adds to rather than detracts from the timeliness of his paper, which in a large measure explains many of the contributory causes for the present political upheaval and holds forth the potentialities, for the days of reconstruction, of a country of vast and numerous opportunities for pioneer development.

The pre-war Russian social and political system portrayed by Mr. Hutchins was responsible for the stunted and dull mental attitude of the Siberian laborer. Graft was rampant and injustice prevailed in the laws and courts. Tools and methods were of the crudest imaginable design, and all attempts at the introduction of progressive ideas were resisted with all the cunning of ignorant suspicion and prejudice. Mr. Hutchins, after pointing out the many shortcomings of the Siberian and his methods, concludes with suggestions for improving conditions which are of interest not only as to mining methods, but especially in the labor situation and the possibilities for the laborer's successful education in honesty and efficiency under strong and skillful administration.

Comparison of costs and mill extractions in Siberia and California shows the waste that prevails in Siberian practice and indicates the possibilities which exist in this extensive and practically undeveloped field.

The Gold Industry and Gold Standard

IN THE present issue we print a clean-cut and carefully prepared article by Hennen Jennings on "The Gold Industry and Gold Standard." Mr. Jennings has steered clear of a discussion of theoretical economic conditions and has confined his attention to the presentation of facts concerning production and the effect of present economic conditions on future output. His discussion of money standards and the relation of labor and wealth is excellent. Mr. Jennings says that to stop gold mining in a time of financial stress would be like closing the doors of a bank when a run is made upon it.

We are in accord with Mr. Jennings that the production of gold is vital at this time and should be encouraged by the removal of the burden imposed by the War Excess Profits Tax. With the point of view that gold mining is one of the non-essential industries, we have little patience. Money, as Mr. Jennings states, must be based on sentiment and good faith, for money, even including gold, has no intrinsic value except as an incentive or stimulant to future human enterprise, effort and labor—its stored value vanishes when the mass of the people repudiate it. If the mass of the people thoroughly appreciated this and coöperated strongly, we might successfully establish almost any kind of money standard. Through the ages, however, the mass of the people has been accustomed to look upon either gold or silver as a standard, and paper money or other forms of currency have maintained an uncertain value ratio in periods of unusual stress. This is a condition we cannot alter. We would, therefore, be most unwise were we to interfere with the steady production of gold or its position as a standard.

Mineralogy

WE OFTEN think of mineralogy as a science in which not much more is to be done in the way of discovery of new species, but closer examination of the current literature shows that this is erroneous. At present about 1200 well-established species are known, and it is surprising how many new ones are added each year. Aside from recent microscopical work, which shows that many supposed minerals are really mixtures of several in part unknown varieties, new finds of importance are

often recorded. We recall the sulphide of vanadium, patronite, found several years ago in Peru. Very recently the long-expected disulphide of tungsten has been identified from the Old Emma mine, in Cottonwood Canyon, Utah. It is of special interest because it resembles molybdenite closely and cannot be distinguished from it except by chemical tests; probably it has been frequently mistaken for molybdenite. Another recent discovery is that the very rare mineral chalmersite, which was found in Brazil, and also was found to exist in large quantity in some copper ores of Prince William's Sound, Alaska. It is a pale yellow sulphide of iron and copper which differs from chalcopyrite in containing only 23% copper.

A new periodical, entitled *The American Mineralogist*, appeared about a year ago as the organ of the mineralogical societies of this country. It is a monthly publication, of the modest size of 10 or 12 pages, but it contains in convenient form all discoveries and data essential to the students of this science, and many collectors and mining engineers would probably be interested in it.

BY THE WAY

Insatiable Curiosity sent two five-cent stamps to the Patent Office in Washington, says the *Wall Street Journal*, in payment for two copies of the patent report in which his curiosity might be satisfied. He received in return mail a courteous letter from a Treasury official announcing that no more copies of the patent paper were in existence. The 10 cents in stamps, the letter said, had meanwhile been turned into the Treasury in payment for something the Treasury could not supply, so it was held to the credit of Mr. Curiosity and would be refunded to him on requisition.

Mr. Curiosity invested in another sheet of paper and envelope and a three-cent stamp and asked for a return of the 10 cents paid for goods the Government could not supply. Then he received a form to be filled out (the second bunch of stationery reaching him under Government frank) and dutifully filled out the form required. He used more stationery and another three-cent stamp, and finally received a warrant for 10 cents from the Treasury, involving more stationery and another frank.

Moral—Guess what Government management for everything would mean.

Commenting upon "hindsights," the *Spelter Journal*, the "safety" publication of the Butte & Superior Mining Co., relates the following: "Some workmen lost control of a cable they were changing at the old Black Rock No. 1 shaft, with the result that it started back down the shaft at a terrific rate of speed (possibly for the reason that no one cared to follow the advice of a confused ropeman who yelled "Step on it!"). The force tore the spool out through the side of the rope house, clipping off the corners of a few buildings en route and finally crashed into and lodged in the headframe of the shaft with sufficient force to bend and twist the steel considerably. Some men on the 1500 were working on a skip chute and had taken the precaution of putting up a bulkhead over them before starting to work. The run-away cable sped down the shaft, struck the bulkhead and silently coiled itself up. The men working beneath did not even know it had occurred. Such an incident may be classified as a "near accident." But its chief lesson is that of "safety first." Had these men not taken the time to build the bulkhead, at least three fatal accidents would have been the result."

Lane Urges Action on Oil Lands Leasing Bill

Secretary Lane sent the following letter on May 4 to Chairman Ferris of the House Committee on Public Lands:

"I trust you will press for immediate action upon the leasing bill. It is nothing less than a national war necessity that the supply of fuel on the Pacific Coast be at once increased. I am in touch with the situation through the Geological Survey and the Bureau of Mines, and the facts before me justify this prophecy that within 60 days railroads, aëroplane factories, shipyards, ships and many industries will be unable to secure oil or fuel of any kind if a bill is not passed under which the producing lands will be opened to the fullest development. If this end can be furthered by placing the whole matter of reserved oil lands in the hands of the President, I certainly would fight for it strenuously."

Third Liberty Loan Subscriptions from the Mining Industry

Total subscriptions to the Third Liberty Loan obtained through the Special Liberty Loan Committee for the mining industry amounted to $27,967,750 at the close of the campaign. In addition to the subscriptions already mentioned in issues of the *Journal* for Apr. 27 and May 4, the following subscribers appear:

E. N. Breitung & Co.	$ 800,000
H. B. Barling	600
Miners of Nicklas Mining Co.	4,800
American Smelting and Refining Co.	1,000,000
Judd Stewart	17,400
Hamilton M. Bruch	1,550
Charles Earl	1,150
S. W. Hills	6,000
H. W. York	5,000
American Metal Co.—Affiliated companies and employees (additional)	442,500
Sidney M. Weil	2,500
Argonaut Consolidated Mining Co.	30,000
Guggenheim Brothers	1,000,000
E. P. Earle	100,000
North Butte Mining Co.	60,000
Michigan Limestone and Chemical Co.	20,000
Michigan Limestone and Chemical Co. (employees)	30,000
Butte & Ely Copper Co.	30,000
Consolidated Copper Mines Co.	70,000
W. B. Thompson	500,000
New Jersey Zinc Co. (additional)	436,400
Aluminum Co. of America	1,200,000
Quincy Mining Co.	100,000
Quincy Mining Co. (employees)	62,600
A. B. Benesch & Co.	50,000
Eugene L. Steindler	17,500

Remember the Comfort Fund of the 27th Engineers.

Personals

Have you contributed to the Association of the 27th Engineers?

H. B. Patton examined oil properties in Wyoming recently.

Edwin E. Chase and his son, **R. L. Chase,** will be in the Baker City gold district until May 9.

J. C. Dick, of Salt Lake City, recently examined manganese prospects at Ely, Nevada.

Dr. R. B. Moore, of the U. S. Bureau of Mines rare mineral station at Golden, Colo., is in New York.

J. B. Tyrrell has left for northern British Columbia, where he expects to spend a few weeks.

Chester W. Washburne, 44 W. 44th St., New York, was married on Apr. 29 to Mlle. Marcelle Gellé, of Paris.

W. B. Colwell and **G. L. Sheldon,** of Ely, Nev., made an examination of manganese properties at Pioche, Nev., in April.

C. W. Rubenson, representing the Norske Molybdaengrubers Faellesforening, of Kristiania, Norway, is in New York.

H. L. Williams, of California, recently investigated the Peace River, Alta., oil field and arranged for developing an oil property there.

G. C. Bateman, general manager of La Rose Mines, Ltd., of Cobalt, Ont., has returned from examining properties in North Carolina.

John H. White, manager of the Climax Molybdenum Co., of Colorado, has returned to Climax after a vacation of several weeks in California.

S. H. Brockunier has been appointed superintendent of the Chateaugay Ore and Iron Co., at Lyon Mountain, N. Y., succeeding **J. H. Cartwright,** resigned.

Frank H. Kaiser, iron and steel chemist and metallurgist with the Sullivan Machinery Co. at Claremont, N. H., has legally changed his name to Frank H. Kingdon.

George O. Argall, general manager of the Iron Silver Mining Co., at Leadville, Colo., has returned to Leadville from New York, where he attended the annual directors' meeting of the company.

H. A. Hansen has resigned as mill superintendent of the Tomboy Gold Mines Co., Ltd., at Telluride, Colo., to accept the management of the Mt. Blaine Oil Shale Products Co., at De Beque, Colorado.

Charles R. Keyes, consulting engineer, of Des Moines, Iowa, has been chosen as Democratic candidate for United States Senator, to succeed Senator W. S. Kenyon, whose term soon expires.

Clarence G. Willard, metallurgist with the Golden Reward Consolidated Gold Mining and Milling Co., of Deadwood, S. D., has accepted a position with the Mine and Smelter Supply Co., of Denver, Colorado.

Sir Douglas Haig, British commander-in-chief, is president of Eldorite, Ltd., the property, which was formerly owned by the Canadian Talc and Silica Co., being situated at Eldorado, Hastings County, Ontario.

E. C. Rafferty and **F. Morse Smith,** of New York, and **George C. Venard,** of Chicago, representing the acid-manufacturing industries, are in Colorado investigating the pyrites situation and recently visited Leadville.

Thomas S. Woods and **N. Wheaton Dean,** the newly elected president and vice president, respectively, of the Winona Copper Co., in northern Michigan, visited the mine recently with **Rex R. Seeber,** superintendent.

P. P. Reese resigned on May 1 as manager of the Superior Steel Corporation's plant at Carnegie, Penn., and has associated himself with the Driscoll Reese Steel Co., Hamburg, Penn., manufacturing electrical steel castings.

Hale H. Hunner, superintendent of the Pearson mine, at Nashwauk, Minn., for the Shada Mining Co., of Duluth, has been appointed superintendent of the Ferro and Algoma mines of the Onahman Iron Co., at Ironton, Minnesota.

E. A. Sporley and **J. Mathews,** who are in charge of mine rescue car No. 7 of the Lake Superior district, have just completed two weeks' instructional work in mine rescue and first aid at the Minnesota School of Mines experiment station.

Alexander E. Fowlie, until recently auditor for the Yak Mining, Milling and Tunnel Co. at Leadville, Colo., has volunteered for war work in the Y. M. C. A. and has departed for New York, expecting to be sent to France in the near future.

H. D. Easton, formerly professor of mining engineering at Kentucky State University, who for some time has been associated with **F. Julius Fohs** as oil geologist, is now in New York, where he will have charge of Mr. Fohs' office at 60 Broadway, during the latter's absence. Mr. Fohs also maintains an office at Tulsa, Okla., and divides his time between the two places.

A. H. Garner, oil geologist on the staff of C. W. Washburne, of New York, has returned from Venezuela, where he spent the last year in geological exploration work, and has enlisted in the Aviation Corps. **K. D. White** has returned from examining oil prospects in Colombia and will make his headquarters at 66 Liberty St., New York. **H. C. Beebe** and **H. L. Baldwin,** of the same staff, have sailed for western Africa. **Pierce Larkin,** of Tulsa, Okla., is engaged on foreign exploration work with Mr. Washburne.

Obituary

C. C. Morgan, superintendent of the January quicksilver mine at Monticello, Napa County, Calif., died on Apr. 8, from burns received from distillate.

Peter S. Roy, of Denver, said to have been the first to strike oil in Colorado, died at Blackhawk, Colo., on Apr. 25. He had various mining and oil properties throughout the state.

A. J. Browning, mining recorder of Elk Lake, Ont., died on Apr. 30 of pneumonia, aged 54 years. He was appointed recorder in 1917, having previously been assistant recorder at Larder Lake.

Societies

American Iron and Steel Institute will hold its fourteenth general meeting at the Waldorf Astoria, New York, beginning May 31, instead of May 24-25 as announced.

Winnipeg Geological Club, organized by J. S. DeLury, left Winnipeg on Apr. 27 for a 10-day excursion to the Falcon Lake country.

National Metal Trades Association at its New York convention elected John W. O'Leary, Chicago, president; Murray Shipley, Cincinnati, first vice president; H. W. Hoyt, Detroit, second vice president; and F. C. Caldwell, Chicago, treasurer.

Engineers Society of Western Pennsylvania met on May 7 at the Carnegie Institute of Technology. The subject discussed was "Training of Mechanics for Maintenance and Repair of Airplanes and Airplane Engines." Addresses were made by Willibald Trinks, professor of mechanical engineering at the Institute, and J. C. Sproule, associate professor.

Mining and Metallurgical Society of America. The New York section will hold a meeting on Friday evening, May 17, at the Columbia University Club. The speaker of the evening will be Major Bashford Dean, Ordnance Reserve Corps, whose subject will be alloys and their significance in the making of modern helmets and body armor. He will exhibit specimens and lantern slides.

American Institute of Mining Engineers, St. Louis section, held its annual banquet and meeting on Apr. 16 at the Mercantile Club, St. Louis. Bradley Stoughton, secretary of the Institute, addressed the meeting. Other speakers were: Philip N. Moore, former president; H. A. Buehler, of Rolla, state geologist; T. T. Brewster, general manager of the Mount Olive & Staunton Coal Co.; F. W. DeWolf, state geologist of Illinois; Maj. J. R. Fordyce and C. T. Orr, of Webb City, Missouri.

National Safety Council. The New York section will meet at the American Museum of Safety, 14 West 24th St., on May 16. Members and visitors will assemble at the museum at 6:30 p. m. and go in a body to the Aldine Club, where a buffet dinner will be served. The program will include an address on "Dust and Fume Control" by C. P. Tolman, of the National Lead Co.; also one on "Shop and Safety Meetings," by W. P. Strickland, of the New York & Queens Electric Light and Power Co. A motion picture, "The Outlaw," will be shown through the courtesy of the Liberty Mutual Insurance Company.

Utah Oil Men's Association, recently organized, has the following officers: E. D. Woodruff, president; L. G. Bradley, vice president; G. F. Barton, secretary; U. S. G. Todd, Franklin McCoy, and C. S. Goddard. An address was made by Myrum Schneider, of the geological department of the University of Utah, on Apr. 23. Through its board of governors, the association is conferring with Salt Lake City officials relative to the recently enacted ordinance providing for the regulation of the sales of stock, and trying to get some amendments incorporated into what will be practically a new ordinance. This will soon be presented to the commissioners for consideration.

Minnesota School of Mines Society held its annual election of officers on Apr. 27 at Minneapolis with the following results: President, Joseph O. Hosted; vice president, Walter R. Mellem; secretary-treasurer, James D. Wheeler; editor, C. Henry Chadbourn; and assistant editor, Edwin N. Carlson. The following lectures have been given before the society during 1917-1918: "War Minerals," Dr. William H. Emmons; "Bureau of Mines Experiment Stations," Dr. Dorsey A. Lyon; "Manganese Problem," Edmund Newton; "Students in War Times," Marion L. Burton; Industrial Russia," Prof. William H. Sternberg; "Scientific Exploration," including a day's demonstration of diamond drilling and bit setting, E. J. Longyear Exploration Company.

Association of Iron and Steel Electrical Engineers, Cleveland section, met in Cleveland on Apr. 27. A paper was presented by T. F. Baily, of the Electric Furnace Co., on "Electric Soaking Pits, Annealing and Heat Treating Furnaces and Furnaces for Melting Non-ferrous Metals." The Philadelphia section met on May 4. H. A. Lewis and W. H. Burr, of the Alan Wood Iron and Steel Co., Conshohocken, Penn., presented a paper on "Electrically Operated Door Hoists for Openhearth Furnaces." The Pittsburgh and Cleveland sections will meet on May 18 at Youngstown, Ohio. The Ohio Works and the McDonald Works of the Carnegie Steel Co. will be inspected. The association will hold its twelfth annual convention at the Southern Hotel, Baltimore, Sept. 9 to 13.

American Association of Engineers has nominated the following men for president and members of the board of directors, to be voted on at the annual convention in Chicago on May 14: President, W. H. Finley, chief engineer, Chicago & Northwestern Ry.; first vice president, H. W. Clausen, city construction engineer, Chicago; second vice president, L. K. Sherman, Chicago, and A. D. Whipple, chief engineer, Portland Cement Association; directors: Harold Almert, Chicago; F. K. Bennett, Minneapolis; T. M. Chapman, Savannah; C. U. Freund and F. R. Weller, Washington; W. A. Goss, J. N. Hatch, Samuel Moreell, Charles A. Morey, J. H. Prior, Warwick Ray, C. B. Reed, E. O. Schweitser, and F. L. Thompson, all of Chicago; Alexander Potter, New York; C. B. Scott, Richmond; and P. B. Waldin, Pittsburgh.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Copper—Electrolytic Deposition of from Acid Solutions. Franz Edward Studt, London, England. (U. S. No. 1,260,830; Mar. 26, 1918.)

Filtration—Continuous Thickening Process. Albert Legrand Genter, Salt Lake City, Utah, assignor of one-half to the General Engineering Co., Salt Lake City, Utah. (U. S. No. 1,263,226; Apr. 16, 1918.)

Phosphate—Process of Making a Mixed Potash Nitrogenous, and Phosphatic Fertilizer. Robert F. Gardiner, Clarendon, Va. (U. S. No.'s 1,261,116; 1,261,117; Apr. 2, 1918.)

Smelting—Method of Treating Sulphide Ores so as to Recover Sulphur and Metal Values. Frank K. Cameron and John A. Cullen, Salt Lake City, Utah, and Reed W. Hyde, New York, N. Y., assignors to American Smelting and Refining Co., Salt Lake City, Utah. (U. S. No. 1,261,694; Apr. 2, 1918.)

Tunnel-Block and Tunnel Construction. Cornelius G. Hastings, West Hoboken, N. J., assignor to Hastings Tunnel System Co. (U. S. No. 1,262,041; Apr. 9, 1918.)

Zinc—Treatment of Zinkiferous Ores. James Hyndes Gillies and Percy McPherson Gillies, East Camberwell, Victoria, Australia. (U. S. No. 1,262,190; Apr. 9, 1918.)

Zirconium Ores, Process of Purifying. William R. Loveman, Lakewood, Ohio, assignor, by mesne assignments, to National Carbon Co., Inc. (U. S. No. 1,261,948; Apr. 9, 1918.)

Editorial Correspondence

SAN FRANCISCO—May 1

Comstock Miners' Wages have been increased. Miners will receive $5 per day and muckers and carmen $4.50. Mechanics and other surface men are to get an advance of 50c. per day.

Protests Against Electric Power Rates, proposed to be advanced by Pacific Gas and Electric Co., have been filed with the State Railroad Commission by the Yukon Gold Mining Co. and the Indiana Gold Dredging Co. The former operates gold dredges in Yuba, Butte and Placer counties and the latter in Sacramento County on Cosumnes River. The Yukon company has also filed protest against raising of rates by the Great Western Power Co. The contracts for power made by these Guggenheim companies are claimed to have been made at a time when the cost of power was the essential element in determining the profitable possibility of dredging in these fields. The power companies have applications before the commission for permits to increase rates in the regions in which these dredging companies operate.

Southern Sierras Power Co. has extended its operating field by absorbing units of the Nevada-California Power and Electric Corporation system. The last of four deals completing the extension was consummated by authorization of the California State Railroad Commission to the Coachella Valley Ice and Electric Co. to sell its properties for $791,320. The assumption of indebtedness by the Southern Sierras leaves the Coachella a balance of $99,617. Purchase price includes no allowance for development cost. The Coachella transmission lines extend from Banning, Riverside County, to El Centro, Imperial County, Calif., and to Yuma, Ariz. The three other properties included in this recent great extension are the Bishop Light and Power, Corona Gas and Electric Light, and Rialto Light and Power. The Southern Sierras now owns the longest aggregate electric transmission line in the world.

March Production of Petroleum in all California fields, according to independent producers, amounted to 8,419,071 bbl., a decrease from February of 5282 bbl. Shipments from the fields in March totaled 8,707,556, as compared to 8,324,066 in February. Stocks on hand Apr. 1 totaled 31,052,769 bbl., a decrease of 288,485 for the month of March. Standard Oil reports give the decrease in stocks for March at 529,062, the stocks on hand Mar. 31, according to Standard figures, being 30,891,316 bbl. Most of the production loss in March is charged to Midway-Sunset and Coalinga fields. In the week ended Apr. 20, according to the figures of R. P. McLaughlin, state oil and gas supervisor, reported by the State Mining Bureau, 24 new wells started drilling, showing revival of drilling activity, and making a total of new wells started since the beginning of January, 212. This is a decrease of 139 from the number for the same period in 1917, but it is greater than the same period in 1916. The new wells of the week are distributed in the following named fields: Los Angeles, Ventura, Santa Maria, Coalinga, Kern. Other branches of field work show no special features.

DENVER—May 2

A Potash Industry in Colorado is the plan of A. E. Carlton and associates, of Cripple Creek. Chemists who are familiar with the Cripple Creek ores state that the phonolite of the Portland, Vindicator, Golden Cycle, Ajax, Granite, and other mines of the district contains an average of 6% potash. Careful experiments have been made, and it has been demonstrated that a satisfactory recovery of potash can be made from these ores, and at a substantial profit. It is estimated that the dumps of the Portland and Golden Cycle mills, near Colorado Springs, contain about 6,000,000 tons of sand which contains from 6 to 10% potash. It is purposed to base the new industry on these dumps and the daily supply of mill sand made in the district that is suitable for treatment. Not only is an attractive profit estimated at present prices for potash, but a satisfactory margin of profit is claimed on a basis of pre-war prices. This estimated profit at pre-war prices is, of course, dependent upon the fact that the supply of raw material to be treated is mill sand which bears little mining and crushing expense. Appreciating these favorable conditions with regard to the raw material, and in view of the high potash content of the Cripple Creek phonolite, the project appears to have attractive possibilities, and its development will be watched with interest.

Owners of Manganese Properties in Colorado are interested in the possibilities of the War Finance Corporation, which was established by Senate Bill No. 3714, signed by the President early in April. It appears that $500,000,000 was appropriated as an operating fund, and authority was granted to issue $3,000,000,000 in bonds for the assistance of essential war industries. The purpose of the bill has been set forth as follows: "That for the purpose of affording financial assistance, either directly or indirectly, to persons, firms, corporations, and associations whose operations are necessary or contributory to the prosecution of the war, in cases where such persons, firms, corporations, or associations shall be unable to procure funds on reasonable or practicable terms from the general public, or through the regular banking channels, and for the purpose of regulating and controlling the sale and offering for sale or subscription of securities hereinafter issued, and for other purposes in aid of the prosecution of the war, the Secretary of the Treasury, together with four additional persons (who shall be the directors first appointed as hereinafter provided) are hereby created a body corporate and politic in deed and in law, by the name, style and title of the War Finance Corporation." To what extent any part of this fund will be employed to increase the production of war materials is not known, but it is not unlikely that, in order to release shipping, an effort will be made by the corporation to stimulate the domestic production of manganese and pyrites, and possibly other minerals.

Minerals-Control Bill was the subject of a hearing of the Committee on Mines and Mining of the House, during the latter part of March. The tentative draft of the bill prepared by the War Minerals Committee proposed to place in the hands of the President the control of tungsten, vanadium, manganese, molybdenum, pyrite, graphite mines and metallurgical works, and to operate the same if idle, excluding gold, silver, copper, lead, zinc and iron mines, from its provisions. Copies of the proposed bill were carefully studied by producers of these metals in Colorado, and early in April a meeting of representative producers of tungsten, molybdenum, vanadium and manganese met in Denver, and were unanimous in the opinion that it was inadvisable to oppose the passage of the bill. A resolution was adopted setting forth that the mining men of Colorado were in full accord with the purposes of the Administration as outlined in the bill, expressing a desire to coöperate to the fullest degree with the Government in its efforts to increase the production of minerals necessary for the successful prosecution of the war, and affirming that adequate and stabilized prices, as provided in the bill, would enable producers of Colorado to contribute a large proportion of the amount necessary to take the place of imported ores and minerals. About the middle of April the bill was reported favorably by the House Committee on Mines and Mining, and is now upon the House calendar for the third reading. Early action is expected upon the bill, and it is not believed that serious opposition will develop in the House to passage in its present form. In the Senate, it is expected that objection will be made to the price-fixing and licensing provisions of the bill, because of the fact that the operation of these provisions in the Lever bill providing for food and fuel control has met with considerable sensational criticism. It is believed by some Senators that these provisions are entirely unnecessary for the purposes for which the bill is to be enacted, namely, the stimulation of production of certain minerals of which the country is now in need. It is believed that the bill will be passed promptly by the House, because of the dire need in which the Government now stands for the release of the shipping now engaged in the importation of manganese, chrome and pyrites, without crippling the steel and explosives industries, which are depending largely upon these minerals for operation.

Federal Leasing Bill is now in the hands of the House Public Lands Committee. Considerable difference of opinion has existed between the Departments of War, Navy and the Interior as to the form in which the bill should be reported, but it is understood that a compromise has been reached and that the committee will make its report at an early date. It is expected that the bill will provide substantial relief for these locators upon oil lands who in good faith prosecuted their development under the provisions of the existing laws. It is hoped that the bill may be speedily enacted; not that it is ideal in its provisions, but that it will put an end to the doubt and uncertainty which had so long hampered western development, and particularly now that there is so great a demand for petroleum for war purposes. It appears that a radical change in sentiment regarding oil and shale legislation took place in Washington following the visit of Colorado oil and shale men in attendance on the recent hearing before the Land Committee. The Administration recognizes as never before the necessity of legislation that will encourage development and production, and the departments which until recently were insisting on drastic regulation have greatly modified their demands, and it is now unlikely that laws will be passed which will hamper legitimate development. However, it should be observed that locators of shale lands must proceed with actual development or production in order to hold title to their land, and that transfers of claims where these conditions do not prevail will not be considered valid by the Government, under the present laws. It is understood that title to shale lands held for sale or speculative purposes, under the present placer laws, will not be recognized by the department.

Colorado Mine Taxation was the subject of serious discussion at a recent meeting of County Assessors at Glenwood Springs. At this meeting, a resolution was adopted that it was the sense of the meeting that a constitutional amendment should be submitted so as to permit of the adoption of income taxes for state and local purposes, and that a bill be submitted to and adopted by the people of the state providing that producing metal mines shall be assessed in the same manner as other property of the state. It is feared by some operators that the Tax Commission and the assessors intend to initiate a bill, to be voted upon at the coming election, repealing the present law and enacting in its stead the unjust and burdensome law which the commission so persistently advocated in the past.

SALT LAKE CITY—May 2

The Big Four Exploration Co.'s sale of the mill at Park City—idle for some time—brings an end to the experiments of that company with low-grade tailings on which it had a lease, accumulated on Homer's ranch. The Farr-Wiebold Electric company, of Salt Lake City, is the purchaser, the sale having been confirmed by the U. S. District Court on Apr. 24. The purchase price was $35,500, and it is understood that the plant will be wrecked or dismantled to obtain electrical and other machinery. Flotation was used in the mill toward the last, and over $250,000 was expended in plant and machinery.

Occupation Tax Notices have been sent out by the State Board of Equalization to mining companies and lessees as follows: "The law provides for an occupation statement from each lessee during the year 1917, whether at a loss or gain, or leased for a short time or long period. All lessees should note the following on their occupation tax statement: Gross field in dollars: the sum total of all checks received from the company in payment for ore. Cost of extraction: Itemize and deduct total cost of labor; itemize and deduct cost of all supplies, if any, not purchased of the com-

pany from whom you lease. Actual net proceeds: the cost of extraction deducted from the gross yield in dollars. Any company or lessees failing to make a statement of their net proceeds to the State Board of Equalization for their operations during 1917 are subject to a fine of $100, and will forfeit the right to protest to any arbitrary assessment made by the State Board. See Sections 2521 and 2522, Laws of Utah, 1907."

BUTTE, MONT.—May 2

The Copper Rod and Wire Manufacturing Plant of the Anaconda company at Great Falls is well advanced, and unless something unforeseen occurs, the plant should be in operation in about a month. So far the company is not experiencing any difficulty in getting all the men required for the operation of its mines and smelteries at this city, Anaconda or Great Falls; and it is fully expected that when the rod and wire plant is ready, labor will be easily obtained. Many labor agitators of the I. W. W. class have been making efforts in this city and at Great Falls to induce men to stop work at the company plants unless certain outrageous concessions are made; but the general opinion is that such an agitation is going to fall flat, especially in view of the sedition act passed at a special session of the Legislature in February.

Anaconda and Montana Power Companies, combined, purchased $3,000,000 worth of third Liberty Loan Bonds, one third of the quota going to the State of Montana. Forty per cent., or approximately $1,200,000, came to the Butte district. This materially helped to swell the Liberty loan purchases in Butte, and in fact the State of Montana. Butte more than doubled its quota in subscriptions to the Third Liberty Loan, 17 individuals or corporations contributing the amount allotted to the city.

RENO, NEV.—May 1

A Traveling Mining School is to be instituted in Nevada under the auspices of the State and the Federal Boards for Vocational Training. The school will travel from camp to camp and give secondary mining training to working miners, millmen, smeltermen, prospectors, and others. This is a departure in mining education which opens up a most promising field, and it is altogether fitting that Nevada—which has been the pioneer in so many mining matters—should be the first state to take up this work. It is purposed to send the school to the camp which first obtains an advance registration of at least 20 men, and to continue in this camp for at least three months, which is sufficient to complete several of the shorter courses or any one of the longer courses.

TORONTO—May 1

The Ontario Department of Mines has granted prospectors leave to proceed with assessment work in the Lightning River district, near Lake Abitibi, which has been suspended for some time owing to its being a part of the timber limits of the Abitibi Power and Paper Co. A large number of prospectors are going in the mining plant for the development of the Howey-Williams Cochenour discovery claims is now on the property, and development will be rapidly pushed.

A Plant for Briquetting Lignite of Saskatchewan coal fields is planned by the Canadian government, acting on the recommendation of the Advisory Council for Scientific and Industrial Research. The cost is estimated at $400,000. The enterprise will be undertaken in co-operation with the Provincial Government of Saskatchewan and Manitoba, each of which will contribute $100,000 of the amount required, the Canadian government furnishing the remainder. The plant will have a capacity of 30,000 tons of briquettes annually, and will probably be situated in the Souris district of Saskatchewan, on account of the present development of the lignite deposits in that locality, and the readily available market for briquetted fuel. The plant will be under the management of a commission soon to be appointed.

The Canadian Copper Co's Appeal, made some time since to the Dominion government, for the disallowance of the Ontario tax was heard last week in Ottawa. It was contended that the act imposing the tax was unconstitutional, first, because it permitted the taxation of assets outside of Canada, and, second, because the tax bore unequally on different taxpayers. The method of assessment for the purpose of the tax was objected to. To determine actual profits at the mine, the act provides that from the market price of the finished product there should be deducted the actual cost of the processes of refining, the resultant figure being the basis of the tax. Therefore, as the company contended, the profits to be taxed included profits made in the United States. Further, it was argued that the act discriminated against the Canadian Copper Co., and in favor of the Mond Nickel Co., as it provided that where ore was refined in Britain the war taxes payable in that country should be deducted from the Ontario tax, while no allowance was made to the Canadian Copper Co. on account of taxes paid in the United States. The Dominion government, acting on the report of Hon. C. J. Doherty, Minister of Justice, has dismissed the appeal and declined to disallow the act.

International Nickel Co. of Canada's increase in the capital stock from $5,000,000 to $50,000,000 indicates construction at Port Colburne will be on a more extensive scale than originally contemplated. It is understood that the company will amalgamate with the Canadian Copper Co., the other Canadian subsidiary of the International Nickel Co. of New Jersey, and that gradually the refining operations now carried on in the United States will be transferred to the Canadian plant. This is the view taken of the matter in official circles. Hon. G. Howard Ferguson, Ontario minister of mines, said in an interview on the subject: "They are gradually working out of the United States and coming here. The plant at Port Colborne has been built on the unit system permitting an extension of refining operations on any scale. We could not well ask the International Nickel Co. to abandon its operations in the United States at once. It will be a matter of gradual change, but ultimately the refining of our nickel is going to be done in Ontario." The reason influencing the company's apparent preparations to extend its operations in Ontario is presumably the present heavy provincial tax, which will annually amount to about $750,000, in addition to which it is liable to any taxation which the American Government sees fit to impose. In so far as its refining is done in Canada it will escape the double tax."

The Mining News

ALABAMA

Coosa County

COOSA COUNTY GRAPHITE PROPERTIES—The Coosa Graphite Co., the Talladega Graphite & Products Co., the Seminole Graphite Co. and the Dure Flake Co. are all constructing plants which are nearing completion. By the end of the year Coosa County will have 12 or 15 plants in operation.

Jefferson County

TENN. COAL, IRON & R.R. CO. (Fairfield)—Work on the 110-in. plate mill is progressing, and it is thought it will be in operation by October.

Shelby County

SHELBY CEMICAL CO (Shelby)—A hardwood byproduct plant costing $600,000 is to be erected and operated in connection with the charcoal iron furnaces of the Shelby Iron Co. Wood alcohol, acetone and acetate of lime will be produced, most of which will be taken by the Government for the Signal Corps.

ARIZONA

Gila County

GIBSON CON. COPPER CO. (Globe)—Possibility that a mill will be erected to treat low-grade ore.

IRON CAP COPPER CO. (Globe)—Vein opened at 900 ft. level shows persistance of orebody.

INSPIRATION CON. (Miami)—Production of copper in April was 9,250,000 pounds.

Mohave County

ARIZONA MOSSBACK (Oatman)—Shaft now down 300 ft., with several hundred feet of drifting and crosscutting on 200 and 300 levels. To start sinking to 500 level soon.

BIG JIM CON. MNG. CO. (Oatman)—Started preliminary work with Arthur Seivert as superintendent. A 90-hp. gasoline engine is being installed and compressor plant to be increased. Shaft to be sunk to depth of 400 ft., from which level it is purposed to crosscut.

TOM REED GOLD MNG. CO. (Oatman)—Ba'd Eagle workings now connected up with Grey Eagle so that ventilation is provided through latter shaft. Orebody of former to be explored by crosscutting every 50 ft. for entire 550 ft. length. Four Pachucha agitators being dismantled and three redwood tank thickeners to be installed.

UNITED EASTERN (Oatman)—Treated 7980 tons of ore in March.

Pima County

NEW CORNELIA (Ajo)—Preparing plans for 10,000-ton concentrator and reverberatory furnaces for future production of sulphide copper ores.

LOWELL GOLD MIN. CO. (Tucson)—Filed applications to sell stock last week. Company originally formed under name of Horseshoe Basin Gold Min. Co. Properties consist of six claims in the Quijotoas.

MAGNATE COPPER CO. (Tucson)—Crosscut on the 80-ft. level reported to have been driven through disseminated copper ore for 25 feet.

MINERAL HILL CON. (Tucson)—Strike reported recently said to be sulphide ore averaging 9% copper at a depth of 500 feet.

PIMA MNG. AND SMELTING CO. (Tucson)—Said to have contracted for 75-tons per day output of Dos Cabezas property.

QUEEN MINE (Tucson)—Native copper in considerable quantity said to have been found at this property in a zone 25 ft. wide.

Pinal County

AMERICAN SMELTING & R. CO. (Hayden)—Completed installation of a coal crushing plant for use of coal instead of oil fuel.

GALIURO MOLYBDENUM CO. (Mammoth)—Plans made for erection of a plant for selective oil flotation.

FORTUNA MINING CO. (Superior)—Property operated by New York interests.

GRAND PACIFIC COPPER CO. (Superior)—To begin hauling ore to railroad. Number of carloads of high-grade smelting ore stocked ready for shipment. Tramway being constructed from third tunnel to new ore bins.

SILVER KING OF ARIZ. (Superior)—Recently opened high-grade milling ore on 120 level. General manager Fowle to install plant equipment as fast as developments warrant.

Santa Cruz County

WANDERING JEW MINE (Alto)—Report strike of high-grade lead-silver ore. Bisbee interests have obtained a lease.

DIXIE MINE (Patagonia)—Reports a strike of considerable value within 20 ft. of the main lode.

RHEA MINING CO. (Nogales)—One of the latest companies to be organized in this district.

TEXAS & NOGALES MIN. CO. (Nogales)—Has just been organized with Lee Regan, of Nogales, as agent.

Yuma County

LITTLE GIANT MINE (Salome)—Recently found ore in east drift.

ARKANSAS

Boone County

K. AND M. (Harrison)—Sphalerite mine operated by Continental Zinc Co., installing compressor.

Marion County

ANNA MAY (Buffalo)—Operated by the Temple Mining Co. Started up new concentrating plant last week.

DIXIE GIRL (Buffalo)—Crosscutting orebody of zinc carbonate. Installing new compressor.

LONE STAR (Yellville)—Property located north of this place and formerly owned by J. S. Cowdery. Recently purchased by D. J. Brookerson and Chas. Moorehouse, of Benjamin, Tex. Development work has been started.

ONWATTA (Yellville)—Lately taken over by the Onwatta Mining Co., a newly organized company. President C. G. Rogers, Yellville; vice president, Geo. W. Caldwell, Altus, Okla.; secretary-treasurer, R. R. Stone, Yellville. Carbonate of zinc orebody has been developed by two tunnels. One, 150 ft., the other 300 ft. long. Contemplate the erection of a mill early in summer.

CALIFORNIA

Butte County

WATER PERMIT granted to R. Jackson, Yankee Hill, to use three second feet of Fraser Creek for mining purposes. Work contemplates crib dam 15 ft. high, 15 ft. long on top and 30 ft. at bottom and a ditch two miles long.

Del Norte County

BIG FLAT (Eureka)—Reported that John Noreen, representing San Francisco interests, has optioned this property and also contemplates optioning Anderson-Watkins copper property on Myrtle Creek, and that prospecting will be by diamond drill.

Kern County

GOLD STATE (Caliente)—Property, situated in Green Mountain district accessible by wagon and truck road and provided with abundance of water and timber, to be developed by Martin J. Errecarte, of Bakersfield. Installation of 30-ton mill contemplated. Property prospected by several hundred feet of tunnel showing possibilities of payable ore.

Nevada County

BUREAU OF MINES CAR (Grass Valley)—Forty-two men completed first-aid training course; new classes immediately started; a ladies' class also attracting large enrollment. Crew completed work here Apr. 20, and the car, which is on a siding at Colfax, will go to Lovelock, Nevada.

KANAKA MINE (Nevada City)—This quartz property below Alleghany has been developed by a 350-ft. tunnel which is being driven to intercept vein at outcrop. Air drills and compressor to be installed later.

BRANT (Spenceville)—Mine was discovered and abandoned about 30 years ago. Recently rediscovered by A. T. Walker, on whose ranch the mine is situated. Reported high-grade ore disclosed in a 30-in. streak in a vein cutting a diorite dike in granite at the contact.

Placer County

DUTCH FLAT DISTRICT is active in placer mining. McGuire diggings, at Lowell Hill, optioned by W. A. Bliss, who contemplates a dam in Bear River. Old Gould diggings, a mile below Dutch Flat, operating with 14 men under management of W. S. MacDonald. Chrome has been discovered on Bear River below Alta by R. E. Linder and D. J. Sullivan.

PLACER COUNTY CHROME CO. (Auburn)—Installation of concentrating machinery in progress at Rattlesnake Flat in enlargement of the plant now in operation. Company also installing plant on the Steele land, in Eldorado County, near Salmon Falls. High-grade ore shipped without concentrating. F. W. Swanton, of Santa Cruz, is manager.

Plumas County

JUNEDAY (Crescent Mills)—Reported that company contemplates construction of electric-power line and 50-ton mill.

DROEGE (Greenville)—Men are employed preparing for reopening mine owned by E. O. Lindbloom, who made a fortune in Alaska mining. This property has been idle recently, owing to water litigation. John W. Daily and other St. Louis men are interested in the reopening.

Sacramento County

CHROME CRUSHING AND CONCENTRATING plant is to be installed at Folsom by Geisendorfer & Farmer for treatment of ores mined at Latrobe, Eldorado County. Mill capacity, 50 tons daily. Ore bins of a capacity of 200 tons to be built. Situation of plant opposite Southern Pacific depot. Concentrates to be elevated to railroad track level and loaded on cars for shipment to Eastern markets.

San Luis Obispo County

LUCKY JAKE (Santa Margarita)—Chrome ore said to be of 45% grade extracted, and reported that the tonnage in sight assures at least two years life of the mine. A. H. Noyes and associates, owners, also have five other claims in this Tassajera district.

Santa Clara County

STANDARD MAGNESITE CO. (San Francisco)—Company has magnesite deposits in this county situated about 30 miles east of San Jose and extending into Stanislaus County.

Shasta County

MAMMOTH (Kennett)—Reported that underground crew has been reduced and more active work devoted to the Stowell and the Shasta King and to the Friday-Lowden, which has cut the Mammoth orebodies at a lower depth than was reached by the Mammoth workings. The Shasta King, owned by the Trinity Copper Co., is being worked under bond by the Mammoth, and the Balaklala is furnishing ore under contract, as also the Bully Hill.

COLORADO

Boulder County

ROYAL GEM MINING CO. (Caribou)—Company to resume active operations in May. Owns 40 acres of mineral land, including the Sago, Mammoth, Royal Gem, St. Peter, St. Paul, Index and Camp Bird properties. Sixteen shafts have been sunk, and payable silver ore has been opened. E. C. Wenzel is manager of the company. Guy Adams, of Boulder, is local representative.

Clear Creek County

RANDOLPH GOLD M. M. & TUN. CO. (Empire)—New incorporation by Frederick T. Henry, Henry E. Hamilton, and Carlisle Ferguson has acquired the mining properties of the old Empire Tunnel company. The surface plant is being overhauled and the tunnel cleaned out preparatory to the resumption of development. The portal of the tunnel is being retimbered.

KELLY TUNNEL (Georgetown)—Democrat Mount property to be reopened. Crosscut advanced 2800 ft. from portal. Tunnel to be cleaned up, and retimbered where necessary, and the surface plant and machinery to be repaired and placed in working order. A small force of men to be employed on development.

EDGAR NO. 2 (Idaho Springs)—Operated under lease through the Big Five Tunnel. Milling-grade ore being shipped to local concentrators.

SILVER GEM MINING CO. (Idaho Springs)—New company with a capital stock of $500,000 organized for the purpose of mine development in Clear Creek County. The incorporators are F. L. Grant, F. E. Wilson, and E. M. Carlson.

DENBIGH MINING CO. (Silver Plume)—Developing the Terrible mines. On the 11th level a body of lead-sulphide ore containing 100 oz. silver per ton was uncovered. The vein is 10 to 18 in. wide. On the 14th level a 12-in. vein has been opened for a distance of 1100 feet.

Custer County

PRINCESS ANNIE COPPER (Westcliffe)—To drive 500 ft. tunnel by contract. Bids now being considered. Considerable good-grade copper ore developed, and tunnel to be driven to facilitate mining.

El Paso County

CRIPPLE CREEK DISTRICT tailings dumps of Portland and Golden Cycle mills at Colorado City will be treated to recover potash, it is stated. Estimated 6,000,000 tons sands in dumps contain 7 to 10% recoverable potash.

HOLLY SUGAR CO. (Colorado Springs)—Purchased large limestone beds west of Colorado Springs, and to build plant at Pike View, near coal mines, for treatment of lime rock. Railroad to be built from quarries to plant at Pike View.

Gunnison County

DOCTOR (Almont)—Snow-slides still blockade road to mine through Taylor Canyon, making haulage of ore and supplies impossible.

ASHBY MANGANESE MINE (Powderhorn)—First shipment of two cars manganese ore gave satisfactory results, and crew to be increased.

GOOD HOPE (Vulcan)—Dynamo installed, and mine and camp will be electric lighted.

M. G. M. & R. CO. (Vulcan)—Auto-truck haulage to railroad to be resumed soon.

Lake County

LEADVILLE UNIT (Leadville)—Regular shipments of pyrite being made from recently discovered shoot between Denver City and Jamie Lee shafts. Operations conducted through Jamie Lee, Harvard and Tip Top shafts, all on Fryer Hill.

MATCHLESS M. & LEASING (Leadville)—Company's No. 5 shaft sunk to a total depth of 380 ft. penetrating the porphyry below all sedimentaries without disclosing so-called "second contact." Sinking discontinued, and further prospecting to be by diamond drilling.

P. O. S. (Leadville)—Being worked by lessees. Work of retimbering 500 level under way preparatory to further development. Several small shoots iron-manganese ore opened in old workings. Other mines in down-town section being reopened by lessees for iron-manganese ore are Bohn and Gray Eagle. These mines drained through Penrose shaft.

Rio Grande County

WORTH (Del Norte)—Decision of the Secretary of Interior has given B. H. DuBois clear title to this group of claims after 28 years' litigation. Two cars shipped in 1888 was last work performed. Claims are valuable for gold ore exposed.

Saguache County

RAWLEY (Bonanza)—Eight-mile aërial tramway now being installed between mine at Bonanza and mill at Shirley, a station on Denver & Rio Grande R. R. Power plant at Salida being enlarged to supply mine and mill.

San Juan County

SUNNYSIDE M. & M. CO. (Eureka)—New bunkhouse erected at mine, and equipped with lockers, shower baths, and amusement rooms. New tramway completed under direction of O. M. Sackett. It is 16,000 ft. long, and the longest spans are 1600 and 1900 ft., with perpendicular drops of 500 ft. The tramway discharges into a steel terminal building, where the ore is weighed by a Merrick weightometer and delivered to three cylindrical steel ore bins, each of 1000 tons capacity. Ore is fed from the bins over steel apron feeders to Marcy ball mills. The mill will begin operations early in May with 500 tons capacity. It is a steel structure on reinforced concrete foundations, laid out upon a 30° slope, on a hillside 100 ft. wide and extending 300 ft. up the mountain side. The ore contains gold, silver, copper, lead and zinc, and will be treated by selective flotation. M. H. Kuryla is manager of the mill. Henry P. Nagel, formerly superintendent of the Vindicator property at Cripple Creek, will be in charge of the mine.

MINNEHAHA (Gladstone)—Property consists of 14 patented claims near Gold King mine, and to be developed and operated by the newly incorporated Minnehaha Gold Mining and Milling Co. The capital stock of the new company is $100,000. The officers are James J. M'Feely, president-treasurer; Alfred V. Dawson, vice-president, and Charles L. Beard, secretary. George Bibb is in charge of the work at the mine.

CONGRESS (Red Mountain)—Property to be operated on a leasing system under the direction of Alvin Kramer. Much development work was done last winter, and payable copper ore was opened. Supplies are now being taken to the mine preparatory to the resumption of active mining.

LACKAWANNA (Silverton)—Mine being operated by the D. L. & W. Mining and Reduction Co. Rapid progress has been made in the erection of the new tramway. In March the company expended over $2000 in improvements. Active development and mining operations to be resumed with the opening of the summer season.

ZUNI (Silverton)—This property has been secured under lease by Ernest Jackson and Joe Anderson. The tunnel is being cleaned out and retimbered, and will be advanced an additional 100 ft. to cut the main Zuni vein.

San Miguel County

TELLURIDE DISTRICT SHIPMENTS in March were as follows: Tomboy, 54 cars; Smuggler-Union and Black Bear, 34 cars to Pueblo and 50 cars to Durango; Liberty Bell, 24 cars; total 162 cars, all

concentrates. During the same month last year 121 cars were shipped.

ALTA (Telluride)—Mill alterations and additions to other buildings still under way.

CARRUTHERS MILL (Telluride)—Ready to resume operations. New Huntington mill installed recently.

LEWIS (Telluride)—Two new development drifts being advanced on vein. Roy Parker is superintendent.

LIBERTY BELL (Telluride)—To remodel mill to treat own concentrates and ship all recovered metal in the form of bullion. Mill treating 270 to 500 tons per day. Most of the ore now being milled is mined from ground leased from the Smuggler-Union company. The new process involves stamping in cyanide solution, grinding in tube mills, thickening, concentrating on tables, pulverization in tube mills, treatment in cyanide bath, precipitation, and melting.

Teller County

SMUGGLER-UNION (Telluride)—Rock slide recently destroyed 70 ft. of high-pressure water line, supplying water for power plant.

EL PASO EXTENSION (Cripple Creek)—Good production being made from development work at Index mine.

VICTORY GOLD MINES CO. (Cripple Creek)—Production started from lease on Howard shaft workings of Mary McKinney company. Teams now hauling ore. H. J. Newton, of Denver, is president.

VINDICATOR (Cripple Creek)—Hayes & Co. lease on 1100 level has opened shoot of ore 12 to 20 ft. wide and 75 ft. long assaying 1 to 4 oz. gold per ton.

WILD HORSE (Cripple Creek)—High-grade ore opened in raise at point below 3rd level of main shaft.

IDAHO

Shoshone County

BIG ELK (Adair)—Samuel B. Holbert, of Pittsburgh, has submitted proposition to company to spend $25,000 in development work. Company capitalized for $2,000,000. Special meeting of stockholders called for May 22. Big Elk is copper-gold property which has been considerably developed through shipment of high-grade ore. Headquarters of company in Wallace.

DOUGLAS (Beeler)—Anaconda company, which has property under lease, is again shipping ore after suspension of three months due to bad roads. Company having difficulty getting cars, which prevents employment of full force of 80 men. Recent ore discovery on west side of canyon promises to prove most valuable part of mine. Ore is zinc-lead-silver.

REX CONSOLIDATED (Wallace)—Stockholders of old Rex Mining company have been notified to send in stock for exchange for shares in the Rex Consolidated company. This will complete the absorption of the old company by the new, and is expected to be followed soon by a resumption of work at the mine.

KANSAS

Joplin District

PLAYTER BROS. (Baxter Springs)—Sold 40-acre tract and partly developed mine five miles west to A. M. Brannon, of Oklahoma City, Okla., and associates, for $150,000. Property has two shafts in rich ore, and new owners will erect 400-ton mill at once.

MICHIGAN

Copper

SENECA (Calumet)—Sunk vertical shaft during month 150 ft. Found foot wall part of Osceola lode 54 ft. below hanging wall with but little copper.

HANCOCK (Hancock)—Production for March, 285,000 lb. copper.

ISLE ROYALE (Houghton)—Shipping 2400 tons daily as compared with 3200 in February.

MAYFLOWER-OLD COLONY (Houghton)—Shaft, sinking on Mayflower lode at depth of 1500 to 2000 ft., now down 400; skip now running, but work delayed owing to influenza epidemic and exodus of men.

NEW BALTIC (Houghton)—Is cutting loading station for second level 130 ft. below first; shaft mostly above lode. Will drift on this and New Baltic lodes 30 ft. east, north and south.

NORTH LAKE (Lake Mine)—Lode found in drift corresponding to one discovered in No. 10 drill hole.

MICHIGAN (Rockland)—Returns of 30 carloads of ore give average yield of 30 lb. per ton; shipped 51,049 lb. of mass. Shipping three carloads daily to Winona mill.

MISSOURI

Joplin District

AMERICAN EAGLE (Neosho)—Preparing to reopen and develop Indian Springs mine, near Silver Plume.

STARK CITY (Stark City)—New 200-ton mill near completion. Ore at three levels, 65, 90 and 190 ft., all three shown in each of seven drill holes. Trent & Co., on adjacent land, have new mill almost completed and have three shafts in ore. McGee & Co. are making extensive improvements to mill and are shipping carload of silicate ore weekly. Entire camp seems about to experience renewed activity. Heavy water flow is no longer so troublesome as formerly.

MONTANA

Silverbow County

BUTTE COPPER AND ZINC (Butte)—Is making a record this year in regard to production. Company is sending 200 tons of manganese ore per day East, and in addition is hoisting a large quantity of zinc and silver ore. The zinc ore averages about 14%, there is about 6 oz. of silver per ton and 5% lead. The manganese ore averages 38 per cent.

BUTTE COPPER CZAR CO. (Butte)—Taken over a short time ago by New York capitalists and will soon have its shaft down far enough to begin crosscutting.

BUTTE AND SUPEROR (Butte)—Getting better results today than at any previous time. Mill working day and night to capacity, and ore hoisted is of a little higher grade than any brought to the surface in the last few months.

BUTTE MAIN RANGE (Butte)—Hoisting daily about 70 tons of ore averaging close to 3% copper and 9 oz. silver per ton. The shaft is now at a depth of 800 ft., and crosscuts are being driven. A higher-grade ore has been found, and the management expects to increase its tonnage output.

EAST BUTTE COPPER (Butte)—Smeltery production in April was 1,811,360 lb. copper and 58,194 oz. silver.

NEVADA

Nye County

TONOPAH DISTRICT—Silver ore production for week ended Apr. 20 was 16,651 tons, of an estimated gross milling value of $181,067. Producers were: Tonopah Belmont, 2301 tons; Tonopah Mining, 3550; Tonopah Extension, 2422; Jim Butler, 583; West End, 973; MacNamara, 535; Montana, 220; Cash Boy, 22; and miscellaneous 45 tons.

COMMERCIAL M. & M. CO (Manhattan)—Leased Big Pine mill and after overhauling and making few additions will treat the oversize segregated from Big Pine operations.

MANHATTAN CON. (Manhattan)—Southeast crosscut on 5th level 185 ft. from station. Last 10 ft. of drift in soft shale. In 20 to 30 ft. limestone formation expected.

UNION AMALGAMATED (Manhattan)—Operating at normal capacity. Output coming from Swanson orebody 600 level. Drift 614 east along Earl fault following foot wall toward possible extension of orebody in Liberty fraction.

WHITE CAPS MNG. (Manhattan)—Crosscut 503 advanced 30 ft. entirely in gold ore of milling grade. Grade expected to increase as heading advances toward hanging wall. Semi-monthly clean-up at mill completed and has proved satisfactory.

OKLAHOMA

Joplin District

HANNA-PRICE-SHARPE (Miami)—Three Miami men plan reopening of three mines, the Myrtle, Mason and Lucile, at Lincolnville.

GREENING (Picher)—New mill placed in operation and initial run showed 20 per cent. concentrates recovery of 65 per cent. zinc grade. Albert Hare, of Oklahoma City, is president.

SOUTHEAST MISSOURI (Picher)—Has connected with compressors of White plant near by to aid in shaft sinking.

SOUTH DAKOTA

Lawrence County

RED CLOUD (Galena)—Leased by Chas. Allen, and shipments of silver-gold ore to be made to Trojan as soon as weather permits.

BISMARCK (Lead)—Property leased to Ed. Manion, former superintendent of Wasp No. 2, and work has started. 200-ton mill to be placed in commission as soon as mine work warrants.

Pennington County

DAKOTA CONTINENTAL (Hill City)—Copper ore taken from surface working at Calumet mine being loaded at Keystone for shipment to smeltery. Golden Summit, under development by company, has closed down.

KEYSTONE DISTRICT—Rhodes and Woods are shipping mica from the George Palmer property, near Spokane. Several cars have already been sent to eastern market.

RHEINBOLD (Keystone)—Regular shipments of lithia being sent to New Jersey. In addition several carloads of mica have been shipped since first of year.

UTAH

Juab County

GEMINI (Eureka)—March shipments, 22 cars.

RIDGE & VALLEY (Eureka)—New strike of ore on 1800-ft. level and five feet of lead-silver ore reported in winze close to boundary between Gemini and Ridge & Valley. Ground recently unwatered by pumping jointly. During first quarter 1918 shipped 200 tons.

Salt Lake City

COLUMBUS-REXALL (Alta)—Case of Monetaire Mining Co.—operating adjoining ground—against the Columbus-Rexall will come up for trial in September. Plaintiff seeking damages for ore alleged to have been removed from property by defendant.

MICHIGAN-UTAH (Alta)—Number of teams hauling ore from Tanner's Flat to Wasatch and accumulated ore piles rapidly diminishing. Tramway again repaired and handling a maximum 80 tons per day, working two shifts.

UTAH ELATERITE (Salt Lake)—Company treating ore from Uintah county, and producing 350 gal. elaterite paint daily.

Tooele County

WESTERN UTAH COPPER (Gold Hill)—Shipments being made at rate of about two cars every three days.

WESTERN UTAH EXT. COPPER (Gold Hill)—Four feet of ore reported opened at depth of 210 feet.

DUGWAY SMELTING (Salt Lake)—Proposed to build smeltery at Dugway, 47 miles from railroad at Faust, starting with 100-ton unit. Preliminary statements and advertisements indicate that contract has been made for ore, and that smelting charges will be $12 per ton. Arrangements are being made for clearing site for proposed smeltery. Pierre Peugeot is directing work.

CANADA

Ontario

PATRICIA (Boston Creek)—Equipment for new mill now on the ground, comprising Blake crusher, 5 x 6 ft. Allis-Chalmers ball mill, classifiers, amalgamating plates and Wilfley tables. Capacity of mill between 50 and 60 tons per day.

COBALT DISTRICT SHIPMENTS of silver ore over the T. & N. O. Ry. in February in tons of 2000 lb. were: Aladdin Cobalt, 33; Buffalo, 460.31; Coniagas, 44; Dominion Reduction Co., 161; Hudson Bay, 41.16; Kerr Lake, 29.70; La Rose, 95.38; McKinley-Darragh, 140.32; O'Brien, 32.16; Penn Canadian, 26.45; total, 1063.48 tons.

GREEN-MEEHAN (Cobalt)—A vein 2 ft. wide of low-grade ore, with a 3-in. pay streak in the center, reported to carry 2000 oz. silver per ton, has been struck at the 245-ft. level.

McKINLEY-DARRAGH SAVAGE (Cobalt)—Savage section of property, showing 8 to 12 acres of conglomerate, is to be reopened.

LAKE SHORE (Kirkland Lake)—First shipment of bullion amounting to $40,000, the result of 23 days' run of the mill, has been made.

TECK-HUGHES (Kirkland Lake)—During March the mill operated 71.5% of possible running time, treating 1969 tons of ore of average grade of $5.86. The gross output was $11.538, as compared with $17.538 gross output in February and $18.765 in January.

WRIGHT-HARGREAVES (Kirkland Lake)—No. 3 shaft has reached 400-ft. depth and crosscutting at that level is under way. No. 2 shaft is down 300 ft.

PORQUIS JUNCTION shipped from the Alexo mine in February 4790 tons of nickel ore.

THOMPSON-KRIST (Porcupine)—This property is being developed from the 400-ft. level of the Vipond-Carter Thompson adjoining.

The Market Report

SILVER AND STERLING EXCHANGE

May	Sterling Exchange	Silver New York, Cents	Silver London, Pence	May	Sterling Exchange	Silver New York, Cents	Silver London, Pence
2	4.7550	99⅛	49⅛	6	4.7550	99⅛	49⅛
3	4.7550	99⅛	49⅛	7	4.7550	99⅛	49⅛
4	4.7550	99⅛	49⅛	8	4.7550	99⅛	49⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

May	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
2	*23½	†	6.50 @6.70	6.47½ @6.52½	6.70 @6.75
3	*23½	†	6.55 @6.70	6.50 @6.60	6.70 @6.75
4	*23½	†	6.55 @6.70	6.50 @6.60	6.75 @6.80
6	*23½	†	6.55 @6.70	6.50 @6.60	6.82½ @6.87½
7	*23½	†	6.55 @6.65	6.50 @6.55	6¾ @7
8	*23½	†	6.55 @6.65	6.50 @6.55	6.92½ @7.02½

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

† No market.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 20c. per 100 lb. above St. Louis.

LONDON

May	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
2	110	110	125	360	360	29½	54
3	110	110	125	360	360	29½	54
4							
6	110	110	125	380	380	29½	54
7	110	110	125	380	380	29½	54
8	110	110	125	380	380	29½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £29½ = 6.2576c.; £54 = 11.4545c.; £110 = 23.3333c.; £125 = 26.5151c.; £260 = 55.1513c.; £280 = 59.3937c.; £300 = 63.6362c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—May 8, 1918

The chief event of this week was the distinct improvement in spelter. Lead continued very dull. In tin there were some small transactions at fantastic prices.

Copper—The refiners are going to be quite unable to supply all of the copper that is wanted this month. Both the French and the British are asking for large quantities, and the demands of our own munitions manufacturers are immense. Refinery production has increased encouragingly, speaking of cathodes, but owing to labor troubles and metallurgical troubles the refiners are unable to melt the whole of the cathode production and cast it into wire bars, cakes and ingots, wherefore the available supply of those final forms of the metal is more deficient than production statistics would indicate.

At the meeting between the copper producers and the price-fixing committee of the War Industries Board in Washington, on May 1, nothing was discussed except the matter of refining contracts. No conclusion was reached, and apparently there was no exhaustive discussion of the subject, anyhow. There was nothing but incidental references to the larger subject of the price for copper after June 1. A meeting of the producers in Washington to consider that matter has been called for May 22.

Copper Sheets are quoted at 31½c. per lb. for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26½c. f. o. b. mill, carload lots. Higher prices are expected.

Tin—The situation in this metal weekly becomes worse. There is no regular market in New York, for the metal does not exist here in anything but sporadic quantities. The only real tin markets now are those near the points of production, viz., Singapore, Batavia and Hongkong. It was reported that a lot of 10 tons of Straits tin, on the spot here, was offered on May 7 at $1.25 per lb. We are unable to verify that report, but without any doubt there would have been buyers at such a price. Chinese No. 1 tin for May shipment is quoted at $0.99@1. The same grade of tin in San Francisco fetches $1.05. In Chicago, the price might be $1.15. These figures are sufficiently indicative of the situation.

We are officially advised that the Dutch government has not put any embargo on the exportation of tin from Banka. However, it is controlling the movement of shipping, which may come to about the same thing.

Lead—This market continued dull, the transactions of the week being very light in the aggregate. This means, we think, simply that consumers are well supplied with lead that had previously been in transit. Railway transportation has now become nearly normal, shipments from St. Louis to Buffalo, for example, coming through in less than two weeks. There may still be some local delays on cars entering the yards in the large cities and seaports. However, it is considered probable that all the lead shipped previous to Apr. 1 has now been delivered.

Although the lead market has continued dull, there have been no signs of further weakness or of any pressure to sell. The largest producers continue to be well booked up, and therefore are not offering any lead, at least not freely. Both producers and railway men are urging consumers to stock up with lead, foreseeing that there are likely to be transportation difficulties next winter.

Zinc—Right from the beginning of the week the market stiffened up on the strength of wide-spread inquiry, which resulted in considerable transactions. To a considerable extent, the inquiry came from speculators, dealers and jobbers, but consumers, especially brassmakers and galvanizers, also showed an interest. Some spelter was sold for export.

Zinc Sheets—Unchanged at $15 per 100 lb., less usual trade discounts.

Aluminum—The price quoted is the Government price of 32c. per lb. but the market is unsettled and there are few transactions, dealers claiming there is no metal to be had at the fixed price.

Antimony—We quote spot at 12¾@13c., on which basis sales have been made this week. Quotations on futures are rather uncertain, several important houses refusing to quote at all.

Bismuth—Metal of the highest purity for pharmaceutical use is quoted at $3.50 per lb. for wholesale lots—500 lb. and over.

Cadmium—This metal is quoted at $1.40 per pound, unchanged.

Nickel—Market quotation is 40@45c. per pound.

Quicksilver—The market is a little easier. We quote California virgin at $117½@120. San Francisco reports, by telegraph, $115, steady.

Gold, Silver and Platinum

Silver—The market is steady, having stabilized itself at about $1 per oz. as a result of the passage of the Silver bill. The Government is making shipments to the Orient to provide for exchange for settlement of purchases of commodities so vital to our industrial needs.

Exportation of silver bullion is prohibited in the latest of the mining decrees of President Carranza of Mexico. A translation of the decree has just been made public by the semi-official Mexican news bureau in Washington. Exportation from Mexico of gold or silver coin, whether it be that of Mexico or of any other nation, also is prohibited. The only exception to the latter order is that silver pesos may be exported if an equivalent value of gold be imported. All customs duties have been removed from imports of gold in bullion or coin.

Mexican Dollars at New York: May 2, 77; May 3, 77; May 4, 77; May 6, 77; May 7, 77; May 8, 77.

Platinum—Refined ingot is quoted unchanged at $108 for such as can be supplied to the open market. The Government pays $105 for the platinum content of crude material.

Palladium—Very strong. We quote $150@155.

Zinc and Lead Ore Markets

Joplin, Mo., May 4—A new basis for quotations of blende became effective this week. Premium blende quotations will represent the price paid for ore entering into rolled-zinc production. Class B quotations will represent the price for ore entering into the manufacture of class B spelter. All other grades will be listed as prime western, as they will enter into the manufacture of that grade of spelter. It is hoped this new classification will give a better general understanding in the trade.

Blende, per ton, high, $77.60; basis 60% Zn, premium, $75; class B, $55; prime western, $40@37.50; calamine, basis 40% Zn, $35@25. Average selling prices: blende $43.68; calamine, $27.20; all ores, $43.39 per ton.

Lead, high, $82.50; basis 80% Pb, $80; average selling price, all grades of lead, $79.72 per ton.

Shipments the week: Blende, 9080; calamine, 283; lead, 1546 tons. Value, all ores the week, $517,290.

Platteville, Wis., May 4—Blende, basis 60% Zn, $52 base for premium grade down to $45 base for second grade. The higher base promised for premium grade is predicted to take effect next week. Lead ore, basis 80% lead, $80 per ton. Shipments reported for the week are 2995 tons blende, 116 tons galena and 1599 tons sulphur ore. For the year to date the totals are: 44,469 tons blende, 2517 tons galena and 18,524 tons sulphur ore. During the week 3055 tons of blende were shipped to separating plants.

Chrome Ore—Considerable business in 45% material is reported done at $1.50 per unit, f. o. b., shipping point, while ore of 36 to 49% grade has fetched $1.25 per unit.

Manganese Ore—Unchanged at $1.20@1.30 per unit for metallurgical ore. Charles Hardy in his report of May 7 says that "The Government is contemplating the enactment of regulations whereby a maximum price will be established for domestic manganese ore. Under the circumstances, no new schedule for May will be issued and contracts can be entered into now only subject to such price regulation as the Government may fix."

Molybdenum Ore—No business is reported, but it is intimated that buyers are willing to come into the market again pro-

viding a price is named that is sufficiently low.

Pyrites—Spanish lump is quotable to those who possess a license from the Government at 17c. per unit on the basis of 9s. ocean freight, buyer to pay war risk, less 2% and excess freight. No change is predicted before Oct. 1 unless the War Board makes some modification.

Tungsten Ore—A rather large business was reported done. Prices remained unchanged at $24.50 for scheelite and $19@24 for wolframite, according to grade. There is said to be a considerable inquiry for ore of 30 to 50% grade, very little of which class of ore now reaches our market from foreign sources, shippers aiming to send only ore of 60% grade or upward, owing to the high freight and expenses of shipping.

Iron Trade Review

PITTSBURGH—May 7

Shipments of Government steel have increased, while other shipments have decreased, in accordance with the agreement made at the meeting Apr. 26 between J. Leonard Replogle, Director of Steel Supplies, and representatives of the steel industry. The War Industries Board had drawn up an order whereby it commandeered all steel, but the order is held in abeyance by reason of the agreement mentioned. While the majority of the mills had been doing substantially as well as desired in the matter of shipping Government steel, some were far behind, and it was desired that all should speed up to the utmost. The programme does not mean that there is no commercial steel being shipped. There are ingots rejected under Government specifications, and croppings from ingots required by specifications, while there is some bessemer steel available, since war orders do not run largely to that grade, and, finally, there are plants that roll only a limited range of finished products, some of which the Government cannot use to any great extent.

Pig Iron—The merchant furnaces are getting out somewhat larger tonnage, but experience strong pressure from customers, nevertheless, for heavier deliveries. Little iron is being sold except to those who have Government orders. W. P. Snyder & Co.'s computations of sales made in April showed $35.20 for bessemer and $32 for basic, or exactly the Government limits, effective Apr. 1. The market is quotable: Bessemer, $35.20; basic, $32; No. 2 foundry, $33; malleable, $33.50; forge, $32, f.o.b. furnace, freight to Pittsburgh in the case of the Valleys being 95 cents.

Steel—It remains the case that there are practically no offerings of soft steel in unfinished form. With the heavier production of shell steel, there should be more discard steel, but the offerings are lighter, probably because the makers have found additional means of using such steel in their own finishing operations. Maximum prices remain at $47.50 for billets, $50 for slabs, $51 for sheet bars and small billets and $57 for rods.

Ferromanganese—The market has continued rather quiet, ordinary quotations being $250 for 70% and $4 a unit for higher manganese content, making 80% $290, but this latter price has been shaded. Prices are delivered. Spiegeleisen, 16 to 18%, remains strong at $70, furnace. A meeting is being held in Pittsburgh today among steel representatives relative to future supplies. The Director of Steel Supplies has stated that he considered the War Trade Board's prohibition of ferromanganese imports as ill considered.

Coke

Connellsville—Car supplies in the Connellsville region have improved somewhat, and the movement is better, but still not up to requirements. Hopes now center chiefly upon the new byproduct plants coming in. The Cleveland plant of the wire company, 180 ovens, is expected to make some coke this week, while the Lorain plant of the tube company, 208 ovens, should begin making coke late next month, also the 640-oven plant at Clairton of the Carnegie Steel Co. This will help the Steel Corporation a great deal, as the three plants, when running full, will make at least 75,000 tons of coke a month. The Solvay plant, in the Ironton district, will be completed some time next month, with 40 ovens, and several 10-year contracts have been made with merchant furnaces in that district. The Connellsville market remains at the maximum limit, $6 for furnace, $7 for 72-hour selected foundry and $7.30 for crushed, over 1 in., per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	May 7
Alaska Gold M.	1⅛
Alaska Juneau	1⅛
Am.Sm.& Ref.,com.	80½
Am. Sm. & Ref., pf.	105
Am. Sm. Sec., pf., A	89
Am. Zinc	14
Am. Zinc, pf.	44½
Anaconda	66
Batopilas Min	1⅛
Bethlehem Steel	84
Bethlehem Steel, pf.	90
Butte & Superior	20
Butte Cop. & Zinc	9⅛
Cerro de Pasco	34⅛
Chile Cop.	16⅛
Chino	43
Colo.Fuel & Iron	43⅛
Crucible Steel	67¼
Crucible Steel, pf.	90
Dome Mines	7
Federal M. & S.	10¼
Federal M. & S., pf.	32
Great Nor., ore ctf.	31
Greene Cananea	44
Gulf States Steel	106½
Homestake	‡75
Inspiration Con.	53⅛
International Nickel	29
Kennecott	33⅛
Lackawanna Steel	84
Mexican Petrol.	96⅞
Miami Copper	28⅛
Nat'l Lead, com.	59
National Lead, pf.	105⅛
Nev. Consol.	20
Ontario Min	9
Ray Con	25⅜
Republic I.&S.,com.	87½
Republic I. & S., pf.	98
Sloss-Sheffield	61⅛
Tennessee C. & C.	17⅜
U. S. Steel, com.	103¼
U. S. Steel, pf.	110
Utah Copper	82½
Va. Iron C. & C.	68

N. Y. CURB†	May 7
Big Ledge	⅜
Butte & N. Y.	⅜
Butte Detroit	⅜
Caledonia	.42
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1
Carlisle	‡2
Cashboy	.09½
Con. Ariz. Sm.	1⅛
Con. Coppermines	5⅛
Con. Nev.-Utah	‡⅛
Emma Con.	.21⅛
First Nat. Cop.	‡1⅛
Goldfield Con.	.25
Goldfield Merger	.03½
Greenmonster	⅛
Hecla Min.	4⅝
Howe Sound	‡4⅛
Jerome Verde	⅛
Kerr Lake	.5.60
Louisiana	50
Magma	34
Majestic	‡.25
Marsh	.05½
McKinley-Dar-Sa.	.39
Milford	‡1⅛
Mohican	‡.25
Mother Lode	.51
N. Y. & Hond.	‡12½
Nipissing Mines	8⅛
Nixon Nevada	.79
Ohio Cop.	1
Rawley	‡2½
Ray Hercules	4⅛
Richmond	‡.56
Rochester Mines	.42
St. Joseph Lead	15
Standard S. L.	⅞
Stewart	.21⅛
Success	.07½
Tonopah	3
Tonopah Ex.	1⅛
Tribullion	⅛
Troy Arizona	.12
United Cop.	‡⅛
United Verde Ext.	40
United Zinc	1⅛
Utica Mines	‡.08

SAN FRAN.*	May 7
Alta	.03
Andes	.15
Best & Belcher	.03
Caledonia	.05
Challenge Con.	.02
Confidence	.04
Con. Virginia	.38
Gould & Curry	.02
Hale & Norcross	.02
Jacket-Cr. Pt.	.05
Mexican	.40
Occidental	‡.60
Ophir	.17
Overman	.01
Savage	.03
Sierra Nevada	.10
Union Con.	.97
Utah Con.	.02
Belmont	3.15
Jim Butler	.74
MacNamara	.13
Midway	.06
Mont.-Tonopah	.10
North Star	.06
Rescue Eula	.10
West End Con.	.79
Atlanta	.08
Booth	.04
Comb. Frac.	‡.02
Florence	.10
Jumbo Extension	.09
Kewanas	.04
Nevada Hills	.04
Nevada Packard	.20
Round Mountain	.29
Silver Pick	.03
White Caps	.39
Big Jim	‡.75
United Eastern	3.95

BOSTON EXCH.*	May 7
Adventure	1
Ahmeek	74½
Algomah	.25
Allouez	49½
Ariz. Com., ctfs.	13
Arnold	.20
Bonanza	.15
Butte-Balaklava	.25
Calumet & Ariz.	.70
Calumet & Hecla	435
Centennial	12
Copper Range	46
Daly West	1⅛
Davis-Daly	5⅛
East Butte	9
Franklin	4½
Granby	76
Hancock	7½
Hedley	12
Helvetia	15
Indiana	‡.50
Isle Royale	22
Keweenaw	1¼
Lake	5⅛
La Salle	2⅛
Mason Valley	4
Mass	4⅛
Mayflower	1⅛
Michigan	2
Mohawk	62
New Arcadian	1⅛
New Idria	15
North Butte	15
North Lake	.60
Oilbway	.75
Old Dominion	40⅛
Osceola	50
Quincy	71
St. Mary's M. L.	50
Santa Fe	.75
Seneca	10
Shannon	4
Shattuck-Ariz.	16
So. Lake	1⅛
So. Utah	.12
Superior	4⅛
Superior & Bost.	2⅛
Trinity	3⅛
Tuolumne	.94
U. S. Smelting	41⅛
U. S. Smelt'g, pf.	43
Utah Apex	2⅛
Utah Con.	10
Utah Metal	2
Victoria	2⅛
Winona	1⅛
Wolverine	27
Wyandot	.60

BOSTON CURB*	May 7
Alaska Mines Corp.	.10
Bingham Mines	‡9⅛
Boston Ely	.90
Boston & Mont.	.56
Butte & Lon'n Dev.	.25
Calaveras	1
Calumet-Corbin	‡.01
Chief Con.	2⅛
Cortez	.05
Crown Reserve	.17
Crystal Cop.	.21
Eagle & Blue Bell	2
Gila Copper	‡17
Houghton Copper	.50
Intermountain	.05
Iron Cap. Com.	18½
Mexican Metals	.39
Mines of America	1⅛
Mojave Tungsten	.06
Nat. Zinc & Lead	.26
Nevada-Douglas	.80
New Baltic	.90
New Cornelia	16⅛
Oneco	.20
Pacific Mines	‡.35
Rex Cons.	.07
Yukon Gold	1

SALT LAKE*	May 3
Bannack	‡.26
Cardiff	3.00
Colorado Mining	.08
Daly	‡1.47½
Empire Copper	‡1.00
Gold Chain	‡.06
Grand Central	‡.40
Iron Blossom	.37½
Judge	5.50
Lower Mammoth	‡.03
May Day	.01½
Moscow	‡.02
Prince Con.	.53
Rico Wellington	.12
Silver King Coal'n	1.50
Silver King Con.	1.92½
Sioux Con.	‡.03½
So. Hecla	‡.65
Tintic Standard	‡1.30
Uncle Sam	‡.00½
Walker Cop.	1.57½
Wilbert	.07
Yankee	.10½

TORONTO*	May 7
Adanac	11⅛
Bailey	03½
Beaver Con.	.26½
Chambers Ferland	11⅛
Conagas	1.90
Hargraves	07½
La Rose	43
Peterson Lake	09½
Temiskaming	29½
Wettlaufer-Lor.	04½
Davidson	33
Dome Exten.	10½
Dome Lake	.19
Hollinger	4.95
McIntyre	1.31
Newray	.18½
Porcu. Crown	.12
Teck-Hughes	40
Vipond	.13
West Dome	.11⅛

STOCK QUOTATIONS—Continued

COLO. SPRINGS	May 7
Cresson Con.	4.56½
Doctor Jack Pot.	.03
Elkton Con.	.04½
El Paso	.10
Gold Sovereign	‡.02
Golden Cycle	1.68
Granite	.30
Isabella	.05½
Mary McKinney	.05
Portland	.94
United Gold M.	‡.14½
Vindicator	.25

LONDON	Apr. 15
Burma Corp.	£4 0s 0d
Cam & Motor.	0 11 0
Camp Bird	0 7 9
El Oro	0 8 6
Esperanza	0 8 6
Mexican Mines	5 5 0
Min. Corp.Can.	0 16 3
Nechi, pfd.	0 10 6
Oroville	0 17 9
St. John del Rey	0 16 0
Santa Gert'dis.	0 12 9
Tomboy	0 17 3

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1916	1917	1918	1916	1917	1918
Jan.	56.775	75.630	88.702	26.960	36.682	44.356
Feb.	56.755	77.585	85.716	26.975	37.742	42.792
Mar.	57.935	73.861	88.082	27.597	36.410	43.620
April.	64.415	73.875	95.346	30.662	36.963	47.215
May.	74.269	74.745	.....	35.477	37.940	.....
June.	65.024	76.971	.....	31.060	39.065	.....
July.	62.940	79.010	.....	30.000	40.110	.....
Aug.	66.083	85.407	.....	31.498	43.418	.....
Sept.	68.515	100.740	.....	32.584	50.920	.....
Oct.	67.855	87.332	.....	32.361	44.324	.....
Nov.	71.604	85.891	.....	34.192	43.584	.....
Dec.	75.765	85.960	.....	36.410	43.052	.....
Year.	65.661	81.417	.....	31.315	40.851	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1917	1918	1917	1918	1917	1918
Jan.	28.673	23.500	131.921	110.000	142.895	125.000
Feb.	31.750	23.500	137.895	110.000	148.100	125.000
Mar.	31.481	23.500	136.750	110.000	151.000	125.000
April.	27.935	23.500	133.842	110.000	147.158	125.000
May.	28.788	.....	130.000	.....	142 000	.....
June.	29.962	.....	130.000	.....	142.000	.....
July.	26.620	.....	128.409	.....	140.400	.....
Aug.	25.380	.....	122.391	.....	137.000	.....
Sept.	25.073	.....	117.500	.....	135.250	.....
Oct.	23.500	.....	110.000	.....	125.000	.....
Nov.	23.500	.....	110.000	.....	125.000	.....
Dec.	23.500	.....	110.000	.....	125.000	.....
Year	27.180	.....	124.892	.....	138.401	.....

Tin	New York		London	
	1917	1918	1917	1918
January	44.175	85.500	185.813	293.227
February	51.420	92.000	198.974	311.525
March	54.388	(a)	207.443	318.875
April	55.910	(a)	220.171	329.905
May	63.173	.....	245.114	.....
June	62.053	.....	242.083	.....
July	62.570	.....	242.181	.....
August	62.681	.....	243.978	.....
September	61.542	.....	244.038	.....
October	61.851	.....	247.467	.....
November	74.740	.....	274.943	.....
December	87.120	.....	298.556	.....
Av. year	61.802	.....	237.563	.....

(a) No average computed.

Lead	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	7.626	6.782	7.530	6.684	30.500	29.50
February	8.636	6.973	8.595	6.899	30.500	29.50
March	9.199	7.201	9.120	7.091	30.500	29.50
April	9.288	6.772	9.158	6.701	30.500	29.50
May	10.207	.....	10.202	.....	30.500	.....
June	11.171	.....	11.123	.....	30.500	.....
July	10.710	.....	10.644	.....	30.500	.....
August	10.594	.....	10.518	.....	30.500	.....
September	8.680	.....	8.611	.....	30.500	.....
October	6.710	.....	6.650	.....	30.500	.....
November	6.249	.....	6.187	.....	30.500	.....
December	6.375	.....	6.312	.....	30.500	.....
Year	8.787	.....	8.721	.....	30.500	.....

Spelter	New York		St. Louis		London	
	1917	1918	1917	1918	1917	1918
January	9.619	7.836	9.449	7.661	48.329	54.000
February	10.045	7.814	9.875	7.639	47.000	54.000
March	10.300	7.461	10.130	7.286	47.000	54.000
April	9.459	6.890	9.289	6.715	54.632	54.000
May	9.362	.....	9.192	.....	54.000	.....
June	9.371	.....	9.201	.....	54.000	.....
July	8.643	.....	8.473	.....	54.000	.....
August	8.360	.....	8.190	.....	54.000	.....
September	8.136	.....	7.966	.....	54.000	.....
October	7.983	.....	7.813	.....	54.000	.....
November	7.847	.....	7.672	.....	54.000	.....
December	7.685	.....	7.510	.....	54.000	.....
Year	8.901	.....	8.813	.....	52.413	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1917	1918	1917	1918	1917	1918
January	$35.95	$37.25	$30.95	$33.95	$30.95	$33.95
February	36.37	37.25	30.95	33.95	30.95	33.95
March	37.37	37.25	33.49	33.95	35.91	33.95
April	42.23	.....	38.90	.....	40.06	.....
May	46.94	.....	42.84	.....	43.60	.....
June	54.22	.....	50.05	.....	50.14	.....
July	57.45	.....	53.80	.....	53.95	.....
August	54.17	.....	50.37	.....	53.95	.....
September	46.40	.....	42.24	.....	48.58	.....
October	37.25	.....	33.95	.....	33.95	.....
November	37.25	.....	33.95	.....	33.95	.....
December	37.25	.....	33.95	.....	33.95	.....
Year	$43.57	.....	$39.62	.....	$40.83	.....

‡ As reported by W. P. Snyder & Co.

Current Prices—Materials and Supplies

IRON AND STEEL

SHEETS—Quotations are in cents per pound in various cities from warehouse, also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	St. Louis	Chicago	San Francisco	New York Current	New York One Yr. Ago
No. 10	4.25	5.52	5.45	6.25	5.45	6.80
No. 12	5.35	6.97	6.80	7.70	6.80	8.50
No. 14	4.35	5.62	5.55	6.35	5.50	6.90
Black						
Nos. 18 and 20	4.80	6.32	6.25	7.15	6.25	7.30
Nos. 22 and 24	4.85	6.37	6.30	7.20	6.30	7.35
No. 26	4.90	6.42	6.35	7.25	6.44	7.40
No. 28	5.00	6.52	6.45	7.35	6.45	7.50
Galvanized						
No. 10	5.25	6.97	6.80	....	6.70	8.45
No. 12	5.35	6.97	6.80	7.70	6.80	8.50
No. 14	5.35	6.97	6.80	7.70	6.80	8.55
Nos. 18 and 20	5.65	7.17	7.10	8.00	7.10	8.85
Nos. 22 and 24	5.80	7.32	7.25	8.15	7.25	9.05
No. 26	5.95	....	7.40	8.30	7.40	9.20
No. 28	6.25	7.77	7.70	8.60	7.70	9.50

STEEL RAILS—The following quotations are per gross ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago Current	Chicago One Year Ago
Standard bessemer rails	65	38.00	65	38.00
Standard openhearth rails	67	40.00	67	40.00
Light rails, 8 to 10 lb.	*3.135 (100 lb.)	58.00	*3.135 (100 lb.)	53.00
Light rails, 12 to 14 lb.	*3.09 (100 lb.)	57.00	*3.09 (100 lb.)	54.00
Light rails, 25 to 45 lb.	*3.00 (100 lb.)	53.00	*3.00 (100 lb.)	52.00

*Government price per 100 lb.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots, together with the warehouse prices at the places named:

	Pittsburgh Current	Pittsburgh One Year Ago	Chicago	St. Louis	San Francisco
Standard railroad spikes, ⅜-in. and larger	$3.90	$3.65	$4.50	$5.30	$6.25
Track bolts	4.90	5.00	5.50	Premium	7.45
Standard section angle bars	3.25	2.35	4.50	Premium	4.90

STRUCTURAL MATERIAL—The following are the base prices f.o.b. mill, Pittsburgh, together with the quotations per 100 lb. from warehouses at the places named:

	Mill, Pittsburgh	New York Current	New York 1 Yr. Ago	St. Louis	Chicago	San Francisco	Dallas
Beams, 3 to 15 in.	$3.00	$4.195	$3.95	$4.27	$4.20	$4.90	$5.50
Channels, 3 to 15 in.	3.00	4.195	3.95	4.27	4.75	4.90	5 50
Angles, 3 to 6 in. ¼ in. thick	3.00	4.195	3.95	4.27	4.75	4.90	5.50
Tees, 3 in. and larger	3.00	4.195	3.95	4.27	4.75	4.90	5.50
Plates	3.25	4.445	4.75-5	4.52	5.00	5.25	6.00

STEEL SHEET PILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

Current	One Month Ago	One Year Ago
$4-5	$3.10	$3.10

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Mill Pittsburgh	New York Current	New York One Year Ago	Chicago	St. Louis	San Francisco	Dallas
¾ in. and larger	$5.25	$4.65	$6.50	$5.50	$5.55	$6.90	$8.00
CONE HEAD BOILER							
¾ in. and larger	5.35	4.75	6.50	5.60	5.65	7.00	8.00
⅞ and 1 in.	5.50	4.90	6.75	5.75	5.80	7.15	8.15
½ and ⅝	5.85	5.25	7.10	6.05	6.05	7.50	8.50

Lengths shorter than 1 in. take an extra of 50c. Lengths between 1 in. and 2 in. take an extra of 25c.

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	New York and St. Louis
Galvanized iron rigging	List + 20%
Galvanized cast steel rigging	Net List
Bright plow steel	30%
Bright cast steel	17½ %
Bright iron and iron tiller	5%

HORSE AND MULE SHOES—Warehouse prices per 100 lb. in cities named:

	Mill Pittsburgh	Cincinnati	Chicago	St. Louis	Denver	Birmingham
Straight	$5.25	$6.50	$6.50	$6.25	$7.50	$6.25
Assorted	5.40	6.50	7.00	6.40	7.75	6.50

BAR IRON AND STEEL—Per pound to large buyers at mill, Pittsburgh:

Iron bars ..... 3.5c. Steel bars .... 2.9c.

COAL BIT STEEL—Warehouse price per pound is as follows:

New York	Cincinnati	Birmingham	St. Louis	Denver	Chicago
$0.12	$0.16½	$0.16	$0.16	$0.17	$0.12

DRILL STEEL—Warehouse price per pound:

	New York	St. Louis	Birmingham
Solid	15c.	14c.	15c.
Hollow	24c.	20c.	...

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh, basing card of Nov. 6, 1917, for steel pipe and for iron pipe:

BUTT WELD

Steel Inches	Steel Black	Steel Galvanized	Iron Inches	Iron Black	Iron Galvanized
⅜, ¼ and ⅝	44%	17%	¾ to 1½	33%	17%
½	48%	33½ %			
¾ to 3	51%	37½ %			
LAP WELD					
2	44%	31½ %	2	26%	12%
2½ to 6	47%	34½ %	2½ to 4	28%	15%
			4½ to 6	28%	15%
BUTT WELD. EXTRA STRONG PLAIN ENDS					
⅜, ¼ and ⅝	40%	22½ %	¾ to 1½	33%	18%
½	45%	32½ %			
¾ to 1½	49%	36½ %			
LAP WELD. EXTRA STRONG PLAIN ENDS					
2	42%	30½ %	2	27%	14%
2½ to 4	45%	33½ %	2½ to 4	29%	17%
4½ to 6	44%	32½ %	4½ to 6	28%	16%

Note—National Tube Co. quotes on basing card dated Apr. 1.

From warehouses at the places named the following discounts hold for steel pipe:

	Black New York	Black Chicago	Black St. Louis
¾ to 3 in. butt welded	38%	42.8%	40 1%
3½ to 6 in. lap welded	18%	38.8%	36.1%

	Galvanized New York	Galvanized Chicago	Galvanized St. Louis
¾ to 3 in. butt welded	22%	27.8%	25.1%
3½ to 6 in. butt welded	List	18.8%	22.1%

Malleable fittings, Class B and C, from New York stock sell at list price. Cast iron, standard sizes, 15 and 5%.

MISCELLANEOUS

FLOTATION OILS—Prices of oils for flotation, in cents per gallon, in barrels:

	New York	Chicago	Denver In Bbl. Lots	Denver In Carload Lots
Pure steam-distilled pine oil	$0.51½	$0.50	$0.30	$0.27
Pure destructively distilled pine oil	.48	.48	.30	....
Pine tar oil	.36	.42	.24½	.19
Crude turpentine	.38	.50	.44	.38
Hardwood cresote	.19½*	....	.34½	.31

*F.o.b. Cadillac, Mich.

SODIUM CYANIDE—New York price is 37c. per lb.; Denver, 44c.; in Chicago, 45c.; in St. Louis, 40c.

SODIUM SULPHIDE—In New York the price per pound is 4c. to 4¼c. for concentrated. 2¼c. to 2½c. for crystals. The Denver price for crystals is quoted at 9c.; the St. Louis price, 5c. for concentrated; the Chicago price is 4½c. Concentrated comes in 500-lb. drums, the crystals in 440-lb. bbl.

ZINC DUST—New York price is 18c. per lb. in 1600-lb. barrel; Chicago, 18c.; in Denver, 13c. f.o.b. Pueblo; in St. Louis, 20c.

ALUMINUM DUST—Chicago price is $1 per lb.

CALCIUM CARBIDE—Price f.o.b. cars at warehouse points east of Mississippi River (except in Alabama, Georgia and Florida) is $97.50 for Cameo, $102.50 for Union miners' carbide. In territory between Mississippi River and the Rockies and in Alabama, Georgia and Florida, add $5; west of Rockies, add $10 to $15.

LINOLEUM—No orders being taken, owing to shortage of manufacturing materials.

HOSE—

Fire	50-Ft. Lengths
Underwriters' 2½-in.	75c. per ft.
Common, 2½-in.	33⅓ %

Air	First Grade	Second Grade	Third Grade
¾-in. per ft.	$0.60	$0.35	$0.30

Steam—Discounts from list

First grade.... 25% Second grade.... 30% Third grade....40%

RUBBER BELTING—The following discounts from list apply to transmission rubber and duck belting:

Competition ..... 40% Best grade 15%
Standard 30%

LEATHER BELTING—Present discounts from list in the following cities are as follows:

	Medium Grade	Heavy Grade
New York	40%	35%
St. Louis	45%	40%
Chicago	30—10%	40—5%
Birmingham	35%	40%
Denver	35%	30%

RAWHIDE LACING—40%.

MANILA ROPE—For rope smaller than ⅜-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft. there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ⅜-in., 8 ft.; ½-in., 6; ⅝-in., 4½; 1-in., 3½; for ¾-in. and larger, in 1200-ft. coils:
1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound

Boston	$0.34½	Denver	$0.30½
New York	.33½	Kansas City	.33½
Cincinnati	.33½	New Orleans	.33
Chicago	.32½	San Francisco	.31
St. Paul	.34	Seattle	.33½

PACKING—Prices per pound:

Rubber and duck for low-pressure steam	$0.90
Asbestos for high-pressure steam	1.60
Duck and rubber for piston packing	1.00
Flax, regular	.90
Flax, waterproofed	1.10
Compressed asbestos sheet	1.00
Wire insertion asbestos sheet	1.20
Rubber sheet	.60
Rubber sheet, wire insertion	.90
Rubber sheet, duck insertion	.50
Rubber sheet, cloth insertion	.25
Asbestos packing, twisted or braided, and graphited, for valve stems and stuffing boxes	1.10
Asbestos wick, ½- and 1-lb. balls	.70

FIRE BRICK—Quotations on the different kinds in the cities named are as follows, f.o.b. works:

	New York	Chicago	Pittsburgh
Silica brick, per 1000	$50.00- 55.00	$55.00-60.00	$50.00- 60.00
Fire clay brick, per 1000, No. 1	45.00- 55.00	55.00-60.00	.....
Magnesite brick, per net ton	135.00-145.00	.....	125.00-135.00
Chrome brick, per net ton	135.00-	.....	150.00-160.00
Deadburned magnesite brick, per net ton	85.00- 90.00	.....	.....
Special furnace chrome brick, per net ton	60.00- 70.00	60.00-80.00	.....

Standard size fire brick, 9 x 4½ x 2½ in. The second quality is $4 to $5 cheaper per 1000.
St. Louis—High grade, $55 to $65; St. Louis grade, $40 to $50.
Birmingham—Fire clay, $25 to $30; Denver, $23, per 1000.

RAILWAY TIES—For fair size orders, the following prices per tie hold:

	Material	7 In. x 9 in. by 8 Ft. 6 in.	6 In. x 8 In. by 8 Ft.
New York	Yellow Pine	.90	.....
St. Louis	No. 1 White Oak	$1.30	$1.11
Chicago	White Oak—Plain	.95	.85
Chicago	White Oak—Creosoted	1.30	1.15
San Francisco	Douglas Fir—Green	1.21	.86
San Francisco	Douglas Fir—Creosoted	2.12	1.52

GREASES—Prices are as follows in the following cities in cents per pound for barrel lots:

	Cincinnati	Chicago	St. Louis	Birmingham	Denver
Cup	7	5¼	6.9	7½	10½
Fiber or sponge	8	6	7.4	7½	15
Transmission	7	6	7.4	7½	13
Axle	4½	4	3.6	3	5
Gear	4½	4½	7.0	7½	6
Car journal	22 (gal.)	3½	4.5	3	6

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00 to 13.00	10.00 to 12.00	12.50	12.00 to 16.50
Colored mixed	8.50 to 12.00	10.00 to 12.00	12.50	11.50 to 14.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows.

	13¼ x 13¼	13¼ x 20½
Cleveland	.....	$52.00
Chicago	48.00	50.00

LINSEED OIL—These prices are per gallon:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Raw per barrel	$1.55*	$1.26	$1.65	$1.25	$1.65	$1.25
5-gal. cans	1.65*	1.36	1.80	1.35	1.75	1.30

*Nominal.

WHITE AND RED LEAD in 500-lb. lots sell as follows in cents per pound:

	Red				White			
	Current		1 Year Ago		Current		1 Yr. Ago	
	Dry	In Oil	Dry	In Oil	Dry and In Oil		Dry and In Oil	
25 and 50-lb. kegs	11.25	11.41	11.25	11.50	11.25		11.00	
12½-lb. keg	11.47½	11.62	11.50	11.75	11.47½		11.25	
100-lb. keg	11.02½	11.19	11.75	12.00	11.02½		11.50	
5-lb. cans	11.82¼	15.25	13.25	13.50	11.82½		13.00	
1-lb. cans	13.72½	14.62½	13.25	13.50	13.72½		13.00	

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	$1.05	List	$1.40	$1.90	$1.05	$3.00
Hot pressed hexagon	.85	"	1.20	1.70	.85	3.00
Cold punched square	1.00	"	.75	1.40	1.00	2.50
Cold punched hexagon	1.00	"	.75	1.40	1.00	3.00

Semifinished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50%
Chicago	50%	45%
Cleveland	60%	50%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
¾ by 4 in. and smaller	30—5%	40—10%	40—10%
Larger and longer up to 1 in. by 30 in.	30%	30—5	35—5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iiron washers:
New York ..... $3.00 Cleveland ..... $3.00 Chicago $3.00

For cast-iron washers the base price per 100 lb. is as follows:
New York ..... $3.50 Cleveland ..... $3.50 Chicago $3.50

EXPLOSIVES—Price per pound in small lots at cities named:

	Low Freezing	Gelatin			Black Powder
	20%	40%	60%	80%	Per Keg
New York	.....	$0.27½	$0.34½	.....	$2.40
Boston	$0.24½*	.27¼	.34¼	.41¼*	....
Kansas City	.20	.26¼	.33¼	.43½	....
Seattle	.17¾	.24¾	.31¾	.41¾	....
Chicago	.18¾	.22¾	.33	.43	....
St. Paul	.20	.23	.28	.....	2.45
St. Louis	.20	.24	.29	.43¼	2.45
Denver	.18	.25¼	.32¼	.42¼	....
Dallas	.23	.29½	.37	.47	....
Los Angeles	.22	.28	.36	.....	....
San Francisco	.17¼†	.23½†	.30½†	.40½†	....

†In carload lots. * 25% and 75% respectively.

CONSTRUCTION MATERIALS

ROOFING MATERIALS—Prices per ton f.o.b. New York or Chicago:

	Carload Lots	Less Than Carload Lots
Tar felt (14 lb. per square of 100 sq. ft.)	64	65
Tar pitch (in 400-lb. bbl.)	20	21
Asphalt pitch (in barrels)	35	40
Asphalt felt	72.50	77.20

PREPARED ROOFINGS—Standard grade rubbered surface complete with nails and cement costs per square as follows in New York and Chicago:

	1-Ply		2-Ply		3-Ply	
	c.l.	l.cl.	c.l.	l.cl.	c.l.	l.cl.
No. 1 grade	$1.30	$1.55	$1.60	$1.75	$1.90	$2.50
No. 2 grade	1.15	1.30	1.45	1.60	1.75	1.90

Asbestos asphalt-saturated felt (14 lb. per square) costs $5.35 per 100 lb.
Slate-surfaced roofing (red and green) in rolls of 108 sq.ft. costs $1.95 per roll in carload lots and $2.20 for smaller quantities.
Shingles, red and green slate finish, cost $5.25 per square in carloads, $5.50 in smaller quantities, in Philadelphia.

HOLLOW TILE—

	4x12x12	8x12x12	12x12x12
St. Paul	.056	.11	.162
Kansas City	.075	.14	.20
Denver	.11	.20	.30
Seattle	.07	.11	.16
Atlanta	.10	.16	.....
Los Angeles	.0633	071	.1966

LUMBER—Price per M in carload lots:

	8 x 8-in. x 20 Ft. and Under				12 x 12-In., 20 Ft. and Under	
	Y.P.	Fir	Hemlock	Spruce	Y.P.	Fir
Boston	.....	.....	$45.00	.....	.....	$35.00
Kansas City	34.50	38.00	.....	.....	39.00	40.00
Seattle	24.50	24.50	24.50	24.50	24.50	24.50
St. Paul	.....	51.50	44.00	.....	.....	60.00
Denver	.....	37.00	.....	33.00	.....	40.00
Atlanta	25.00	.....	.....	.....	30.00	.....
San Francisco	.....	28.00	28.00	28.00	.....	28.00

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and G. 10 In. x 16 Ft.	
	Y.P.	Fir	Hemlock	Y.P.	Fir
Boston	.....	.....	$35.00	.....	$35.00
Kansas City	47.25	53.00	53.00	54.50	58.00
Seattle	24.50	24.50	24.50	24.50	24.50
St. Paul	.....	39.00	38.50	50.00	44.00
Denver	.....	37.00	32.00	.....	32.00
Atlanta	.....	37.00	.....	30.00	.....
San Francisco	.....	.....	28.00	.....	28.00

NAILS—The following quotations are per keg from warehouse:

	Mill Pittsburgh	St. Louis	Dallas	Chicago	San Francisco
Wire	3.50	4.30	4.25	4.40	4.80
Cut	3.75	5.25	4.40	4.25	6.40

PORTLAND CEMENT—These prices are for barrels in carload lots, including bags:

	Current	One Month Ago	One Year Ago
New York	$2.59	$2.55	$2.40
Jersey City	2.50	2.50	2.16
Boston	2.81	2.87	2.20
Chicago	2.36	2.21	2.16
Pittsburgh	2.46	2.46	2.16
Cleveland	2.59	2.59	2.29
Denver	3.40	3.20	2.89

LIME—Warehouse prices:

	Hydrated per Ton		Lump per 300-Lb. Barrel	
	Finished	Common	Finished	Common
New York	$16.50	$13.50	$2.35	$2.10
Kansas City	21.20	19.20	2.00†	1.90†
Chicago	15.00	12.00	1.90	1.60
St. Louis	14.00	.....	.....	1.50
Boston	17.00‡	15.00‡	2.85	2.70
Dallas	16.50	.....	.....	.....
San Francisco	17.00	.....	.....	1.65
St. Paul	17.00	14.00	1.35*	1.25*
Atlanta	15.50	14.00	1.20*	.....
Seattle	17.00	.....	.....	2.00‡

Per 180-lb. barrel. †200-lb. barrels. ‡In paper.
Denver—Hydrated in 50-lb. sacks is 65c.; lump is $2.15 per 180-lb. bbl.
Note—Refund of 10c. per bag, amounting to $2 per ton.